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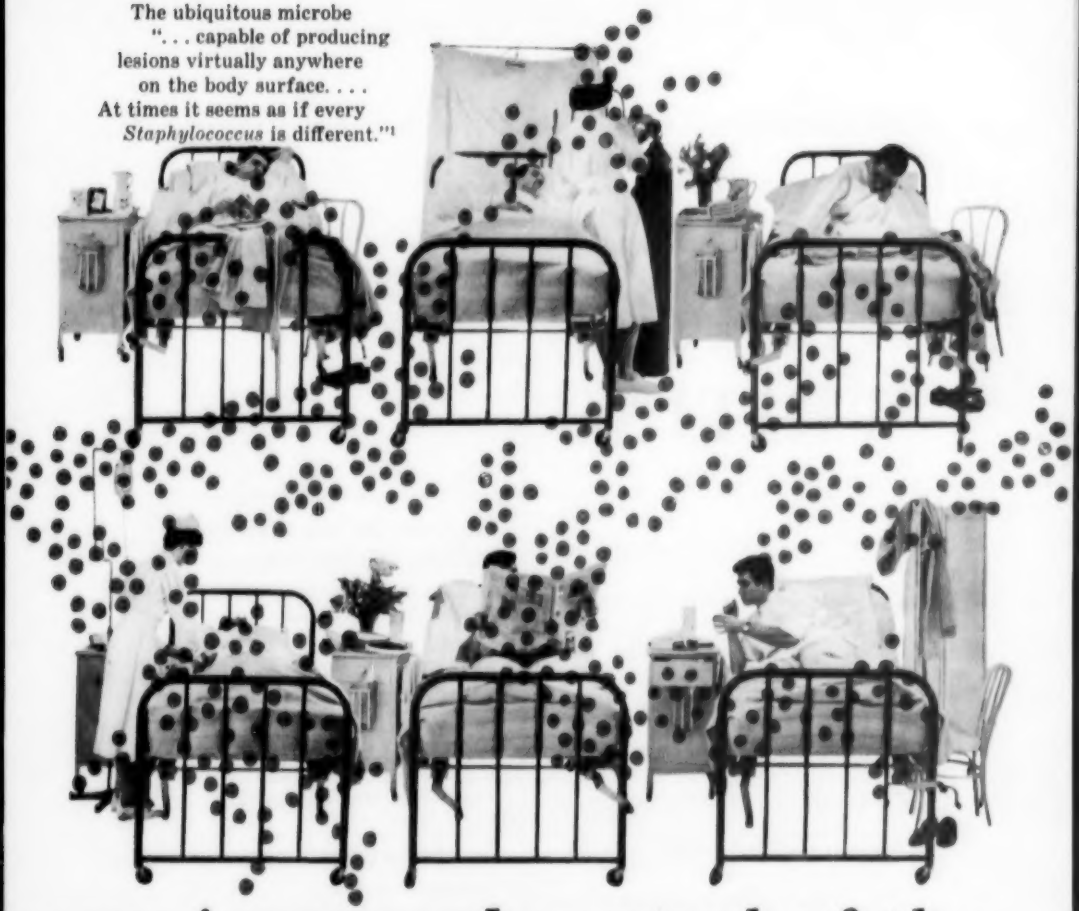

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HARVEY TERCENTENNIAL ISSUE

The Adventures of William Harvey, and of His Discovery

Douglas Guthrie, M.D., F.R.C.S.

EDINBURGH, SCOTLAND

We are met today to celebrate, or rather to commemorate, the death three centuries ago of one of the greatest of public benefactors whose influence upon the progress of medicine, so far from diminishing as the centuries roll on, seems rather to grow and extend. It is only right and proper that we, looking back upon his achievement, should recall some of the details of his life and some of the strange facts regarding the acceptance, and the rejection, of his discovery of the circulation of the blood, which inaugurated a completely new outlook in the teaching and practice of medicine. Under the present circumstances one can deal only with a few aspects of this great theme, and I propose to confine my remarks to Harvey's travels, to the adventures of his discovery in its battle with the critics, and, as is appropriate this year as we recall his death, to the later years of his long life.

But before I ask you to follow the wanderings of Harvey the traveler, let me briefly refer to the lectures and "orations" associated with his name.

Among Harvey's many benefactions to the Royal College of Physicians of London was a sum of money to endow an annual oration. This was to consist of "a commemoration of all the benefactors of the said College, with an exhortation to the Fellows and Members to search and study out the secrets of Nature by way of experiment." The first oration was delivered in 1656, a year before Harvey's death, and there have been many memorable orations right up to the present time. They were given in Latin until the year 1865.

The Harveian Society of London, founded in 1831, has sponsored occasional

Delivered at the Harvey Tercentennial Celebration, Charter Day Program, of the New York Medical College, Flower and Fifth Avenue Hospitals, April 22, 1957.

lectures since 1875, but this Society has no official connection with the Royal College of Physicians.

Half a century older than the London Harveian Society is the Harveian Society of Edinburgh, founded by Dr. Andrew Duncan in 1782. Andrew Duncan, Professor of Medicine at Edinburgh University, is remembered as a great founder of clubs and societies. Among them was the Aesculapian Club, founded in 1773, a dining club that still flourishes. To be a member has always been considered a high honor.

A few years later, Andrew Duncan established another club, with unlimited membership, its object being "to commemorate the discovery of the circulation of the blood, and to cherish a kindly feeling among members of the medical profession." Originally called the Circulation Club, it came to be known as the Harveian Society of Edinburgh, and since its commencement in 1782 it has held an annual Festival, consisting of an oration by the president for the year, followed by a formal dinner in honor of William Harvey. The first oration was in Latin, given by Duncan himself, but all subsequent orations have been given in English. As in the London orations, the practice has been to commemorate some famous man: not always a medical man.

From the story of the Harveian orations in London and Edinburgh, let us turn to the story of Harvey himself, and especially to the travels and journeys that played so important a part in his life.

Two years ago I made various pilgrimages in pursuit of Harvey—to his birthplace at Folkestone, his school at Canterbury, Caius College at Cambridge, and in London, St. Bartholomew's Hospital and the Royal College of Physicians—though Harvey would scarcely recognize any of these scenes today—also to Oxford, where, in the last stages of the Civil War, he continued his studies in embryology, using the eggs of a hen which his friend George Bathurst obligingly accommodated in his rooms, and finally to Harvey's last resting place in the little village church of Hempstead in Essex.

How vastly the British scene of Harvey's labors has changed. Abroad, he seems more clearly to fit the picture, especially in Padua where, though the city is sadly scarred by bombing, one may still see the anatomical theatre where Harvey followed the demonstrations of Fabricius, and the pulpit used by Galileo, who did for science what Harvey did for medicine, replacing vague argument by accurate measurement.

During the 25 odd years after his return from Padua, Harvey was busily engaged in London—as Physician to St. Bartholomew's Hospital and in private practice, as Physician to the King, and as Lecturer to the College of Physicians. This period culminated in the publication of his book in 1628.

In 1630 he was chosen to accompany a wealthy young nobleman, the Duke of Lennox, on a grand tour of France and Spain. It was hoped to include Italy, but that part of the tour was canceled because of plague. Of this tour there exists only the scanty detail contained in a letter from Harvey to Lord Dorchester. He writes from Spain, "We could scarce see a dog, crow, or anything to anatomise."

Harvey's next journey was to Scotland, in 1633, in his capacity as Physician to the King. When Charles I, having ascended the throne of England in 1625, came north to be crowned King of Scotland at Holyrood Palace, Edinburgh, in June 1633,

Harvey was with the Court, as also was Archbishop Laud, whose "liturgy" gave such offense to the Scots. Although the crowns of England and Scotland had been united in 1603, the two countries still had separate parliaments, and the union was far from satisfactory. The English regarded Scotland as a barbarous and foreign land, as indeed they still do, to some extent. King Charles held that both Church and State were subject to his authority, and this attitude led to bitter quarrels on both sides of the border, to civil war, and eventually to the King's execution in 1649. At the time of the Scottish coronation, the Court remained in Edinburgh for several weeks, and Dr. Harvey made good use of his spare time by visiting the island known as the Bass Rock, in the Firth of Forth, to study the nesting habits of the gannet or solan goose, which breeds there in great numbers. This visit he describes at some length in his *De generatione*.

Along with 15 other courtiers he was presented with the Freedom of the City of Edinburgh, and the College (or Incorporation) of Surgeons admitted three surgeons of the Royal household to their membership. There was no College of Physicians to honor Harvey in like manner; that College was not founded until 1681.

King Charles I visited Scotland again in 1641, this time in a much more chastened mood. He traveled as far north as Aberdeen. Harvey was with him, but we know little of the visit, save that Harvey, as in Edinburgh, received the Freedom of the City. Unfortunately, there is no record of his meeting with any Scottish physicians of that period.

Now let us turn to another of Harvey's tours in Europe, of which a clear account is available. It was in 1636 that Harvey had the good fortune to make his third Continental journey and of this tour we have a clearer record, revealed in a number of letters that came to light in 1911, letters from Harvey to Basil Fielding, afterward Earl of Denbigh, who was, at the time, English ambassador at Venice.[1, 2] After he performed the post-mortem examination of Thomas Parr, the old countryman aged, or said to be aged, 157 years, who was brought to London by the Earl of Arundel, Harvey was invited by the Earl to accompany him on a mission to Vienna, ostensibly an embassy but really an expedition to acquire art treasures for the King. Harvey, a patron of the arts and an expert critic, readily assented. The party left England on April 7, 1636—almost exactly 321 years ago—sailing from Margate and landing in Holland. Then they proceeded up the Rhine, then up the River Main, "in a boat, or barge, drawn by nine horses." It was a leisurely journey, but at length the party reached Frankfurt on May 3, and then Nuremberg (May 11 to 22), where Harvey demonstrated the circulation of the blood to the professor of anatomy, Caspar Hoffmann, who had been his fellow student at Padua but who was among those who misunderstood the discovery, saying that it was "contrary to the wisdom of Nature." "I beg you to observe," Harvey had written, "and to see the thing with your own eyes." Nevertheless, Hoffman remained unconvinced, and asked such stupid questions that eventually Harvey laid down his knife and left the theatre.

The second misfortune of this tour was of an entirely different nature. The travelers stayed in Vienna until July 1, and on the return journey Harvey left the main party at Augsburg with the intention of traveling to Italy. He went by way of Munich and Innsbruck, then to Treviso, where he writes (August 3), "I have re-

ceived a very unjust affront." It was alleged that he had passed through a plague-stricken area without having his bill of health, the all-important passport, duly countersigned and cleared. He continues, "I am fallen into the hands of a base and evil people, and while they delight to exercise their tyranny, I am to lie in the open fields for God knows how long, and I fear it will do hurt to my health." It is difficult to understand why Harvey, a medical man and a person of importance, should have been singled out and virtually imprisoned in quarantine for over a month. Perhaps the delay explains why he did not return to visit his old friends at Padua. Also, the 35 years that had elapsed since his student days must have brought many changes, and it is often very depressing to revisit the old scenes of one's youth. Eventually set free, he did reach Venice, where his reception was very different, as the next letters show. We have little knowledge of the homeward journey; we are told that Harvey visited the school of anatomy at Leyden, that he had a rough crossing from Rotterdam, and that he landed at Deal on December 27, 1636.

Now let us turn to another aspect of Harvey's activity, namely, to the adventures of his famous book, and the curiously tardy acceptance of his great discovery. The *Anatomical Disquistion in the Motion of the Heart and Blood in Animals*, often called, for short, *De motu cordis*, published at Frankfurt in 1628, is a clear, brief, and logical account of the author's researches. As we read this little classic, the most important medical book ever written, we find the discovery so plainly set forth that we marvel that it was not immediately accepted. Indeed, the real significance of Harvey's work in the practice of medicine was not apparent for at least two centuries, and it took about 50 years before those best qualified to judge, the anatomists and scientists, appreciated its significance. Why this long delay in the acceptance of a truth so obvious? For the first part of the delay, the discoverer himself was responsible. Harvey lectured on the circulation for 12 years before putting his views in print. When his book did appear, many regarded Harvey as a crank. As Aubrey remarks, "T'was believed by the vulgar that he was crackbrained and he fell mightily in his practice."

It is sometimes said that Harvey's discovery was a mere accident, that all the evidence was there, awaiting the genius who would grasp the opportunity of assembling the facts. There could be no greater error. Since student days at Padua, and perhaps even then, Harvey was continuously at work building up his argument and confirming each step by observation and experiment. His novel methods of investigation were in themselves deterrents to the acceptance of his results. Harvey had not only discovered the circulation of the blood; he had proved the efficiency of the scientific method in medical research. The discovery of a principle or a method is always more important than the discovery of a fact, as it leads to further advances. That is one reason for the long delay in belief in the circulation of the blood.

And there is this further point—not only did the new discovery arise from the application of new methods of research; it could be accepted only by those who were prepared to discard the old beliefs. Before the new idea could be approved it was necessary to disprove the old. Before Harvey's day it was known that the blood moved, but with an ebb and flow motion in the veins, like the tides of the sea. It was thought that there were two kinds of blood: the dark variety, which

originated in the liver and carried nourishment to the body, and the brighter colored blood, which came from the heart and supplied heat. The ideas were all very obscure and very hypothetical. Many anatomists ignored Harvey's doctrine and continued to teach along the well-worn lines. Others were actively opposed to the new explanation, for various reasons, and often for very little reason at all.

Then there were also the so-called "practical" folk, who asked what was to be the use of this teaching. Did it really matter which way the blood moved? Had the so-called discovery saved any lives? According to the loquacious Dean, Gui Patin, of Paris, it was simply "an ingenious piece of fiction." This demand for a clinical outcome of his discovery was anticipated by Harvey when he wrote, "Many questions in medicine, physiology, pathology and therapeutics can be answered by the truth we have declared, but my whole life would not suffice for the completion of the work." More than once he refers to his "Medical Anatomy, in its application to Medicine." Perhaps this manuscript, like his notes on the generation of insects, was lost when the College library was destroyed by fire or when his rooms in Westminster were raided by a mob during the Civil War. Those were calamities that he greatly deplored.

One of the earliest critics of Harvey to state his views in print was James Primerose (Primrosius), a physician of Hull who had studied under Riolan in Paris, and who evidently wrote merely for the sake of writing, upholding the older views in a work printed in 1630. He would probably have attracted little attention had he not been answered in a thesis at Leyden, *De circulatione*, by Roger Drake, a Cambridge student, who upheld Harvey's views. Drake was supported by one of his teachers, Hendryk du Roy (Henricius Regius), of Utrecht, who entitled his work "A sponge to wash away the dirt of Primrosius," which called forth from Primerose a reply headed "An Antidote to the poisonous sponge of Henricius." Both works are dated 1640.

Harvey took no part in those controversies, well knowing that neither of the critics had taken the trouble to really understand his views, and that they based all their arguments on the old conception.

From those critics, most of them slaves of the age-long teaching, and sworn Galenists, it is a relief to turn to those who were ready to accept the new view regarding the circulation or at least to ascertain for themselves by experimental methods whether it could be true. Of those supporters, one of the first was Robert Fludd, whose mystical works were printed in Frankfurt by William Fitzer, who also published Harvey's masterpiece.

René Descartes, the philosopher, in his *Discours de la méthode* (1637), accepted Harvey's principles, and so did Francis Glisson, whose classic work on the liver *De hepate*, reinstates the liver in correct perspective. As early as 1639 the renowned Francis de la Boe (Franciscus Sylvius) was giving demonstrations of the circulation, in dogs, to his class at Leyden.

Nathaniel Highmore in 1642 introduced the new discovery into his textbook on anatomy, dedicated to Harvey, which gives one of the earliest descriptions of the circulation. Sir Thomas Browne, whose view must have carried weight, said that he regarded Harvey's discovery as greater than the discovery of America—rather a bold statement.

Of course the most helpful of the critics were those who took the trouble to repeat Harvey's experiments, rather than merely argue about them. Such a person was Hermann Corning of Helmstadt, whose book *De sanguinis circulatione* (1643) brought strong support to the doctrine. This, surely, was the only true method of appraising Harvey's work, by repeating his experiments, by applying to his results the method he himself used to secure them.

In Scotland, it was left to Archibald Pitcairne to champion the cause of Harvey and, in his *Dissertationes medicine* (1701), to show by mathematical reasoning that all the blood that reached the organs and the periphery returned to the heart. By this time the existence of a movement of circulation was accepted, but it was argued that only part of the blood returned by way of the veins. Although Pitcairne's view has long since become obsolete, he deserves credit for being the earliest Scottish writer to accept Harvey's discovery and for proving the importance of the value of mathematics and statistics in the solution of medical problems, a method upheld by Louis of Paris a century later and quite recently applied still more closely to modern medicine.

Not one of the earlier critics claimed that the circulation of the blood was already known and had been discovered by someone else before Harvey. The claim of Cesalpinus was mentioned for the first time in 1655 by Nardi. This claim is followed by allegations that the discovery was made before the time of Harvey, by Colombo, Ruini, Servetus, and others. It is true that Servetus had discovered the lesser circulation, as also had Colombo and Ibn-Nafis. The interest of Servetus in the blood stream arose from his desire to find a habitat for the soul. The physiologic work of Servetus was first quoted by William Wotton in 1694; it had attracted no attention until then. The trend of Servetus was to theology rather than to physiology, and it was because of his Unitarian views that he suffered martyrdom in 1551.

These claims for priority are not fully substantiated, and they need not detract from Harvey's wonderful discovery. The neglect of Harvey's great discovery during those early years was a phenomenon peculiar to the age in which he lived. Never again will any scientific discovery encounter such strange adventures. The experimental method of investigation, so strange and novel to Harvey's critics, is now familiar to the newest medical student. Indeed, the speed of integration of new discoveries today has become almost terrifying and dangerous, and it is therefore advantageous for us to recall what happened in the seventeenth century.

On this occasion, when we are met to do honor to William Harvey on the three hundredth anniversary of his death, it is only fitting that one should conclude with a brief reference to his later years and to his last illness. Seven years before his death he had been visited by his friend Sir George Ent, who tells us in one of his letters, "When I visited that great man, the chief honour and ornament of our College, Dr. William Harvey, I found him busy with the study of natural things, his mind serene, his countenance cheerful. I asked if all were well with him. 'Truly,' he replied, 'did I not find solace in my studies, and a balm for my spirit in the memories of my former years, I should feel little desire for longer life. Yet this life of obscurity, this vacation from public business, which causes tedium and disgust to so many, has proved a sovereign remedy to me. Though much has been made out by

learned men of former times, I have still thought that much more remained behind, and I have often laughed at those who have fancied that nothing could possibly be added to their knowledge.' He showed me his work on the Generation of Animals, composed with vast labour and care, and I urged him to make it public. After making some difficulties, as he judged the work to be incomplete, he entrusted the papers to my care, and I took my leave, feeling like another Jason laden with the golden fleece, and amazed that our Harvey should set so little store by his admirable observations." The book was published the following year.

At his own expense, Harvey built and furnished a library for the College and this was opened in 1653 by Harvey himself.

In 1654 he was unanimously nominated as President of the Royal College of Physicians, but he declined this high honor because of advancing years and infirmity. I have mentioned how he founded the Harveian Orations in 1656. He was staying in the house of his brother Eliab at Roehampton near London at the time of his death.

It is satisfactory for us to recall that the music of Harvey's earthly pilgrimage ended, in June 1657, on a happy and peaceful note. He was full of years and honor. He had seen his discovery accepted and taught in many schools. Though he had known sorrow and disappointment, his family life had been surrounded by an atmosphere of affection and domestic comfort. Now, at the end, smitten by cerebral hemorrhage and aphasia, and unable to speak, he remained calm and undaunted, though he knew that death was in the doorway. By making signs, he summoned his nephews to his bedside and gave to them his ring, his watch, and other gifts—and that same evening he was gone. Such is our final glimpse of the good and noble Harvey.

In June 1957 many will visit his last resting place in the village church of Hempstead in Essex, some 50 miles northeast of London. Two years before Harvey's death, his brother Eliab, who died four years after him, had built the Harvey Chapel as a family place of burial. Centuries later, it fell into disrepair, but it was rebuilt by the College of Physicians in 1882, and a marble sarcophagus took the place of the leaden casket. Still later, the tower was reconstructed and a tablet records the fact.

There, we may take our leave of Harvey as we do him honor 300 years later, one whose service to humanity, so devoted and unselfish, has been of incalculable value. And it is only fit and proper that we should feel conscious of his presence in spirit at this gathering, the unseen guest whom we are met to commemorate, three centuries after his death, or perhaps we should rather say after his passing on to wider service.

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Padua and London

A Harveian Tale of Two Cities

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There is no better way to celebrate this memorable day than by paying homage to William Harvey, supreme symbol of the medical investigator whose entire life is dedicated to the search for truth as the only key to goodness, freedom, and beauty.

Osler said that "history is the biography of the minds of men." His thought was anticipated centuries ago by the great Renaissance physician, Geronimo Cardano, who said that "a man is nothing but his mind." Today, we shall start together on a pilgrimage into the mind of Harvey. Our most distinguished friend and eminent historian, Dr. Douglas Guthrie, will speak with far more authority than I could about the adult years of Harvey and his great discovery.

I shall talk to you about Harvey as a physician and about the cities and the historical period in which he lived in the years prior to his discovery. I shall make a brief sketch of Harvey "seen from the inside," of Padua and London in Harvey's times, of his great teachers, and of the artistic and philosophical trends of the Renaissance and Baroque that influenced his thought and work. In a series of flash backs we shall see how Harvey came to present in a lecture delivered in London 341 years ago today his discovery of the circulation of the blood.

The occasion was the second of his Lumleian Lectures, the time 10 o'clock one bright spring morning, April 17, 1616, the scene the new Anatomical Theatre of the Physician's College in Amen Street. In the audience there were some 40 distinguished men with highly critical minds, fellow members, licentiates, and candidates of the College. There were also several illustrious laymen, Digby, Ashmole, and Samuel Pepys, and others, the "curious," as they were called, for whom the anatomy lectures equaled the theatre in attraction. Under the auspices of the president, censors, and fellows of the College, and with an anatomical treatise set on the table, the prosector standing by the skeleton, and the tabulae for the dissection of the arteries, veins, and nerves hanging from the wall, the lecturer began his oration.

"A small, dark man, wand in hand, with piercing black eyes, and a quick, vivacious manner" (Osler), he still had the salt of youth stamped on his face. He was William Harvey, then 38 years old. He talked in Latin interspersed with English words. There was a prolonged break between the morning and afternoon lecture when the company went out for one of those "fine dinners" that Pepys so much enjoyed describing.

Towards the end, after discussing in a novel, modern way the structure of the heart in action, Harvey summed up in a few words that the blood moves in a circle. *Few among the audience*

Delivered at the Harvey Tercentennial Celebration, Charter Day Program, of the New York Medical College, Flower and Fifth Avenue Hospitals, April 22, 1957.

William Harvey (1578–1657). From the engraving by J. Hall after the portrait by Cornelius Jannssen at the Royal College of Physicians, London, England.

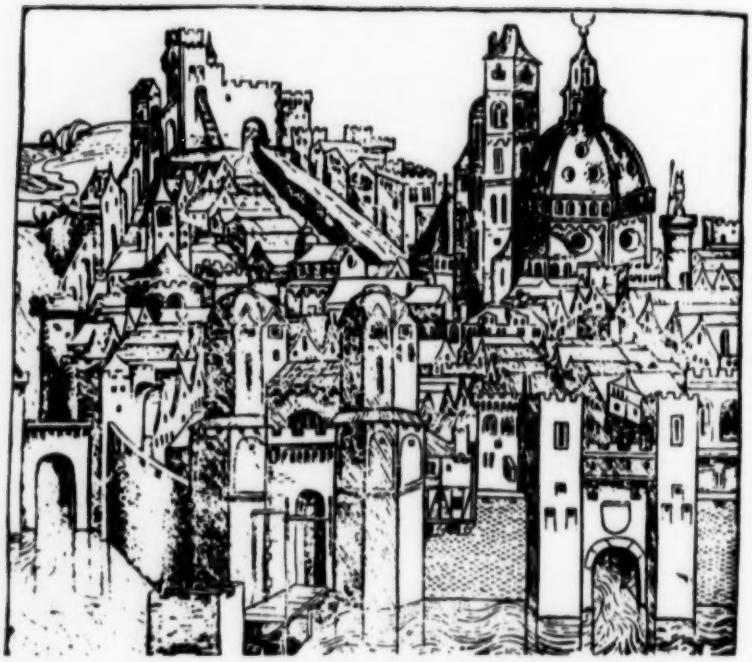
appreciated the meaning of these history-making words, and a few were actually critical of them.

I shall now endeavor to tell you the story behind Harvey's words and his youthful endeavors, for which I shall have to take you to the Padua and London of three and a half centuries ago.

SPRING IN PADUA

It was spring 1598 in Padua. Stirred by tender breezes, the city unfolded like a flower before the eyes, wide with curiosity and wonder, of students from all Europe. From England and Germany, Switzerland, Spain, France, the Low Countries—from all over in large, noisy flocks the students came. Some arrived on foot, their capes threadbare, their shoes battered and dusty; but their moustaches were smartly curled, and their bearing, perhaps in the futile hope of concealing their poverty, was haughty. Others arrived in elegant carriages, followed by their servants and even their minstrels, their purses bulging with *zecchini*. Some clasped books—then a costly rarity—in their arms, and perhaps between the pages a rose was pressed, a nostalgic souvenir from the faraway homeland. But all of them, rich and poor, had one and the same longing for knowledge and adventure. Padua had beckoned and they had come. For three centuries Padua had shed the purest and brightest cultural light upon Europe. This group of students, the cream of European youth, would later yield, thanks to Padua, some of the most brilliant minds of the old continent.

The arrival in Padua was at first a great disappointment. Those who came from



The city of Padua in Harvey's times.

nearby Venice still had before their eyes the image of their lyrical city, as impossibly beautiful as a fantastic dream, sleepily reclining like a fairy tale princess by the lapping waters of its lagoons, where like graceful black swans the gondolas silently glided. Those from the North brought the vision of their home towns, neat and compact, the light from mist-veiled skies rendering the streets into a nostalgic painting by an old master.

But Padua appeared to them to be noisy and far too bright. The sun glared down at high noon; the colors were violent at sunset. The streets were narrow; the houses low, often without glass in the windows. Ankle deep in the mud of the streets, a petulant crowd jostled and chattered, as generous with their gestures as with their quarrels.

Late at night Padua acquired some of the mystery of neighboring Venice. The dark, winding streets were suddenly peopled by silent furtive figures. Knights and ladies wrapped in concealing cloaks, giggling wenches and amorous students, princes and rascals alike, preceded by flaming torches or shrouded in darkness, roamed the streets in pursuit of love, fortune, and adventure. When the stars atop the sleeping campaniles began to fade and stillness finally descended upon the city, fresh breezes swept in from the Adriatic, laden with the romantic and picaresque echo of the canals of Venice whose pale waters were to bear the adventurous gondola of Casanova.

And then came the dawn. The limpid sky was rent by the sharp song of the cocks like glass by a diamond. The students, like birds escaped from a cage, flocked down the streets of Padua. It was then that the city unfolded its beauty before their eyes.

From the Prato, radiant with spring, the students beheld Santa Giustina with its eight Byzantine domes glistening in the sun; and the Church of St. Anthony, its pointed spires soaring in the blue, its arches tall and slender, its white marble façade, fashioned like that of a Roman basilica, supported by black marble columns, its balcony like those of a Venetian palace, its exquisite friezes, deep in marble foliage, peopled by horses, fish, cherubs, and swans. There the townspeople prayed to the city's patron saint, St. Anthony, he who in the twelfth century talked with the fish he dearly loved, as St. Francis talked with the birds.

In the Chapel of St. Felix azure cupolas vied with golden canopies, and inside the church the saints and madonnas seemed eager to escape from altars and tapestries.

In the piazzas, the silent aristocracy of arrogant statues stood watch over the city, and everywhere flowering gardens peeped out over walls and fences, enameling the city with polychrome colors.

This was Padua, grave of medieval dogma and cradle of a new knowledge that heralded the Renaissance. The students felt indeed fortunate to be here! Under the spell of beauty and youth, their blood ran warmer in their veins. Their capes bellowed out and the plumes atop their hats fluttered in the breeze. The chimes of bells rolled blithely through the air. Padua was festive and gay.

PADUA TODAY

Padua is no longer like this. I was there not long ago, following the footsteps of Vesalius. Today the city is shabby, dusty, wearisome. The blazing streets are cluttered with traffic, the noisiest perhaps in the world. If one is coming from Venice, as I was, one steps out from the gondola on the mainland and then travels by automobile or bus for nearly two hours through dusty, flat country. The monotonous landscape wearies the eyes, and one remembers with nostalgia the canals, *piazzettas*, and palaces in the magic city left behind, where the wheel is unknown and the only audible sounds are the tolling of bells, the flapping of wings, the gentle lapping of oars, and the mellow chant of the gondoliers.

The pale waters of Venice are replaced by the parched land of Padua. Everything here is old without the dignity of age, ugly without the character that ugliness can often attain, and dirty without the picturesqueness that sometimes accompanies dirt.

But let one forget the city and cross the threshold of the ancient, dilapidated university. It is not space one crosses; it is time. Every portal here leads back to the glorious Renaissance. You may sit on the hard benches where the students listened to Galileo expound his theories. You may sit, as I did, on Vesalius' chair, a sacred relic relegated to a corner under the indifferent care of a charwoman. And, above all, you may step into the anatomical theatre, no larger than a doll's house, where Fabricius of Acquapendente unveiled the mysteries of generation and in the flickering candlelight dissected the venous valves. Here are the very same walls

that sheltered an English student named William Harvey; here the windows through which he glanced at the Paduan skies.

Padua has now become transfigured, shining forth with the magic light of the past, with the gleaming reflections of history. And in one's heart one feels the glory that was Padua.

THE STUDENTS IN RENAISSANCE PADUA

In Harvey's time the sparkling rivers Brenta and Brachiglioni encircled like two silver bracelets the city of Padua. Padua had been wrested by the Venetian government from the Carrara family, who had long ruled the city. Students loved Padua because the university, like that of Bologna, was governed by the students themselves, whereas in Paris and Oxford the masters ruled.

The University of Padua was organized in 1222 by a group of students from Bologna who, dissatisfied with that city's government, emigrated to Padua, taking with them some of their favorite teachers. The new university was originally set up as an independent community composed only of students and of teachers selected by the students. In those days students went wherever taxes were lower, teachers were better, and life was freer and kinder. Space in some cities was so scarce that, in Paris, for instance, schools shared the same buildings with brothels, much to the students' delight. In Italy the situation was partly remedied by all sorts of barriers contrived between the two "institutions of learning."

Medical schools in those days were called schools of "artists," since medicine was considered one of the seven liberal arts. Students were grouped according to their language and nationality. In 1288 there were four groups of students in Padua: Latins who spoke the *langue d'oïl* (French and Normans); Latins who spoke the *langue d'oc* (Provençals, Catalans, and Spaniards); Germans; and Italians. All the groups, however, were usually designated as *transalpines* or *cisalpines*, according to the side of the Alps they came from. Each group, or *natio*, had its own "councilors" and special privileges. Frequently national pride started many a dialectic quarrel, which often ended in bloody battle.

THE ORIGIN OF THE UNIVERSITIES

The first universities were the fruit of ecclesiastic philosophy. God was the Supreme Educator, and the university was the result of the Church's endeavor to organize education. Medieval scholasticism united the concepts of Plato and Aristotle and the wisdom of Arabian-Jewish philosophers. Monasteries were the first medieval teaching centers. The original curriculum comprised the *trivium*, or grammar, dialectic, and rhetoric, and the *quadrivium*, or arithmetic, geometry, music, and astronomy. The two sections combined constituted the "seven liberal arts." These teaching centers called *scolae publicae* were replaced by the *studia* in the twelfth century, and this name was later extended to the entire educational institution. In the same century the term was changed to *universitas magistrorum* and later to *universitas*, which thereafter encompassed all the disciplines or faculties.

The first European teaching institution to which the term "university" may be correctly applied was Bologna, which in 1156 already had a medical school. Godfathers of anatomy at Bologna were Taddeo Alderotti and Mondino. There, in February, 1302, the first recorded autopsy was performed under the supervision of two doctors and three surgeons on a subject who, it was suspected, had been poisoned. It has been said, however, that in 1281 an autopsy was performed on a plague victim.

In Padua, medical teaching began in the year 1250, and by the fourteenth century the students were well organized into faculties of sciences and medicine. Their teachers, originally selected by the students, were later appointed by the Venetian Senators.

THE TEACHERS OF PADUA

The fame of Padua's teachers attracted students from all over Europe. The golden age of Padua began with the great teacher, Pietro d'Abano, early in the thirteenth century, reached its peak with Vesalius in the middle of the sixteenth century, and ended with Galileo, a contemporary of Harvey. Pietro d'Abano still lives in his philosophico-medical work and in his proud statue on a square in Padua. His noble visage, which resembles that of his pupil Dante, looks down at the curious visitor with the same piercing glance that held spellbound the great crowds of students who flocked from all over to hear him lecture.

Influenced by the Arabian commentators on Aristotle, Pietro d'Abano created an Averroesian atmosphere in Padua that contrasted with the scholastic atmosphere of Bologna. His efforts, however, to reconcile Arabism with scholasticism ended tragically when he was accused of heresy and sorcery—he who had traveled to Constantinople to learn Greek that he might read Galen and Aristotle in the original and who had taught in Paris!—and was condemned to burn at the stake. Mercifully, death overtook him during his trial, rescuing him from the flames. His students succeeded in hiding his body, and the authorities had to content themselves with burning him in effigy in the public square.

Early in the fourteenth century Padua was officially granted by Pope Clement VI all the privileges of a *studium generale*, and it became an epidemiological center. By the end of the fourteenth century Venice had codified sanitary legislation to protect herself from the constant menace of plagues brought to her shores by trading vessels loaded with the silks, metals, and spices vital to her economy.

In the fifteenth century Pope Sixtus IV granted Padua a dissection permit, and Alessandro Benedetti, professor of anatomy, proposed the construction of an anatomical theatre fashioned after the Colosseum of Rome or the Arena of Verona, with ushers to collect a sitting charge so that more instruments might be bought with the money. The Emperor Maximilian, the aristocracy of Venice, and the public at large were invited to attend the dissections.

Toward the close of the fifteenth century printing was developed, and the Venetian Republic published more than 1500 books in the last 10 years of the century, which greatly contrasted with the scarcity of books in Paris. It now became possible to replace gradually the old medieval anatomical diagrams with those of Leonardo da Vinci, Titian, and the Paduan sculptor Andrea Riccio. The printed word, with its

magic power of propagation, inflicted the mortal blow to medieval esotericism, which had been based mainly on the difficulty in transmitting scientific concepts.

THE ENGLISH "NATIO"

Foreign students in Padua steadily increased, as revealed by the ancient books, today kept in Padua's medical school library, in which the *conciliarii* of each nation recorded the most important facts about their group. English students became so numerous that in 1534 the *natio Anglica* split from the *natio Scota*. In 1603 the English, Scots, and Irish were again united in the English nation and had a councilor, a beadle, a secretary, their own library, and special privileges. And while English students flocked to Padua in search of academic freedom and perhaps the radiant Italian sky, Italian humanists traveled to England at the request of the Duke of Gloucester, brother of Henry V, which greatly stimulated learning in England.

In the fifteenth century the University of Bologna also had an English *natio*, the first students of which were Oxonian clergymen. They were followed by the founders of the modern English scholarship, Grocyn, Linacre, and Latimer. Linacre studied humanism in Bologna and graduated in medicine at Paris. Back in England, he became a true *uomo universalis*. Erasmus was one of his pupils at Oxford. Linacre left a fortune to found chairs of medicine at Oxford and Cambridge. Caius also studied at Padua and left the mark of his learning upon Cambridge, whose medical college still bears his name.

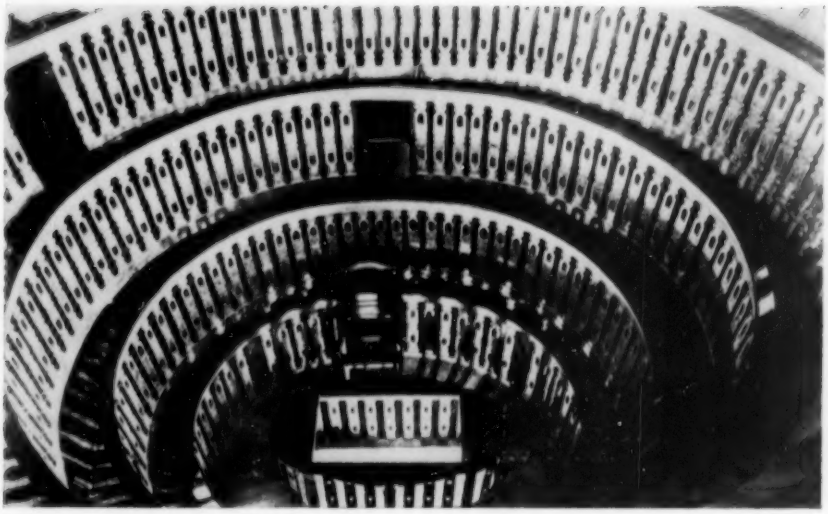
THE ANATOMICAL THEATRE

And now let us go back to that glorious spring in 1598 with which this narration began. The students in gay, noisy bands repaired to the university. Chattering blithely they entered the beloved *Il Bo* (The Ox) building, so called, according to some, because it was located on the site of an ancient hostelry called the *Hospitium Bovis* (at the Sign of the Ox), or, according to others, because of the ox and wagon tax levied to support the anatomical theatre. The students clambered up the stairs to the anatomical theatre, erected four years before on the initiative of Laurentius Massa, secretary of the *Reformatori* of Venice.

I visited the anatomical theatre last year and I still recall my emotion at seeing the small hall, barely 25 by 35 feet, in which students must have crowded most uncomfortably. The small oval pit is surrounded by six ascending galleries as narrow as those of a provincial Spanish bull ring. Students must have stood on tiptoe to peer through the beplumed hats of those below them.

More than 300 students elbowed, nudged, and jostled one another, vainly trying to repress their restlessness and discomfort while waiting for the dissection to begin. Voices, curses, and shuffling feet echoed so loudly in the hollow wooden box that was the anatomical theatre that sometimes street musicians were brought in to keep the students quiet while they waited for the teacher to arrive.

Outside, in the piazzas of Padua, the midmorning sun had already set the towers aflame and the sky glared down fiercely. Inside, the window curtains were pulled and darkness descended upon the theatre. Two four-candle candelabras and eight



The anatomical theatre in Padua, where Harvey watched (1598–1602) Fabricius dissect the venous valves.

candles were lighted and held aloft by students. Shadows capered on the wooden walls. The air reeked of sweat, the old leather of boots and scabbards, and the dead flesh of the corpse to be dissected.

The entrance of the academic dignitaries was greeted with solemn silence. The rectors of the university and the city, together with high officials from Venice, occupied the seats at one end of the dissecting table. The teachers lined up behind them, and, since the pit was too small for all of them, some were forced to stand in the *luoghi a basso*, the empty space underneath the first tier from which they watched the dissection through small openings. Councilors of the various nations occupied the first tier; behind and above them, students crowded into a human pyramid.

At the other end of the table sat the *Massarii*, or anatomists, who were chosen by the rectors and councilors and who organized the course, purchased the wood for the construction of the theatre, which was dismantled at the end of the course, secured the necessary instruments and the corpses, and, until Fabricius stopped it two years before, in 1596, collected entrance fees from the students.

According to the law, the city allowed the university only two corpses a year, one male and one female; but the *Massarii* or the students themselves did not hesitate to steal bodies whenever possible and even created riots, as when in the previous year they had tried unsuccessfully to steal the corpse of a youth from the Church of Santa Sofia.

Fabricius' entrance always created a moment of drama. The wooden door squeaked like a soul in agony, and all eyes at once turned to it expectantly. The candlelight flickered over the small, dark man, dressed in black, a gold chain hanging from his

neck. His beard was short and aggressive, his eyes small and malicious, flashing with impatience and irritation.

The students knew only too well Fabricius' quick temper. Once, angry because a pupil failed to step aside when they crossed on the sidewalk, he announced that thereafter he would always carry a dagger, "ready to prove that he could use it for purposes other than dissection." Although he was a true teacher, he nevertheless was forever trying to postpone his classes, which he would have liked to limit to once every two years. His reputation was so great that not only tailors, cobblers, butchers, and shopkeepers, but even street peddlers tried to sneak into his classes.

Trouble also always attended Fabricius' classes. Once, the night before his class, the dissection instruments and the head and limbs of the corpse disappeared. Often the relatives of the dissected subject complained forcibly because the remains after dissection were tossed to the dogs or into the river instead of being given Christian burial. Sometimes the Syndics arrived late at the dissections and the *Massarii* promptly quarreled with them. On one occasion, a *Massari*, an ill-tempered Sicilian, rushed with his dagger upon a Syndic right in the middle of a lecture. Fabricius himself constantly quarreled with the students, particularly those of the German *natio*, the most powerful of all. He so much enjoyed making fun of and mocking them that the Germans finally boycotted his classes.

Fabricius' dissections were so slow that he spent two months on a head while the students grew more impatient every day, fearing that he would not reach the abdomen before summer. He gave lectures on working days and "extraordinary" lectures on holidays. Anatomical demonstrations were given during the winter only and lasted three weeks, three hours daily in the morning, although sometimes they were resumed in the afternoon.

The bells of the University tolled twice daily, in the morning and in the afternoon. The twenty-fourth hour was sundown. In the winter the bells tolled from the fourteenth to the fifteenth hour in the morning (7:00 to 8:00 A.M., our time), and in the afternoon from the twentieth to the twenty-first hour (1:00 to 2:00 P.M.). Fabricius dissected at the hour of *tertia matutina*, the third hour after the morning toll (11:00 A.M., our time).

But let us rejoin the students at the anatomical theatre. Fabricius occupied his place at one end of the table in front of the *Massarii*. His visage, sallow, almost waxlike, was grave as he stooped over the skinned corpse. The flickering candlelight, like the tongue of a compassionate, devoted dog, licked the gaping flesh.

A STUDENT CALLED HARVEY

On one of the tiers, in the group of the English *natio*, there was a youth intently watching the master's expert hands bejeweled with the rubies of gout. The young man was about 20 years old and looked like a Spaniard or an Italian, short, dark, with black, shining eyes like two mustard seeds. His name was William Harvey.

William Harvey was born April 1, 1578, at Folkestone, Kent, the eldest of the seven sons of Thomas Harvey, Mayor of Folkestone, and Joan Hawke, related to the Counts of Bristol. When William was 10 years old he entered the Grammar School

of Canterbury, where Chaucer's winged fantasy still lingered. It was the year when the skies of England echoed with gunbursts of victory over the Invincible Armada of Philip II of Spain.

In 1593, at the age of 15, Harvey entered the Gunville and Caius College, Cambridge, and four years later he received his degree of Bachelor of Arts. It was the year of the Earl of Essex's and Sir Walter Raleigh's expedition against the Spaniards.

The atmosphere of Caius College undoubtedly influenced Harvey's future life and work. The College had been founded in the fourteenth century by Edmund Gunville and enlarged in the sixteenth century by John Keys, also called Caius (1510–1573), physician, humanist, former student at Gunville and Padua, and Master of the College from 1559 until his death. In Padua Caius had studied with Vesalius (1539) and, together with Realdo Colombo, had taught Greek physics and Aristotelian logic. It was Caius who, together with Thomas Linacre, encouraged sixteenth-century English physicians to import the sun-bathed Italian culture to their misty shores.

His studies at Cambridge over, Harvey's eyes turned to Italy. There art and nature flourished. There humanism and culture lent medicine wings with which to soar to freedom. There the giants of anatomy and science—Vesalius, Colombo, Fabricius, Casserio, Galileo, and Santorio—spread their knowledge. And so, still in the throes of puberty, Harvey traveled to the town that Shakespeare later called, "Fair Padua, nursery of the arts."

PADUA—LIGHTS AND SHADOWS

To understand the forces behind Harvey's discovery it is indispensable to understand various factors neglected by his biographers. They are the burden of our dissertation: the historical crisis in Europe in Harvey's time; the background of the cities where he studied medicine; the rhythm of his own biological development based on a concept that we shall call "of the generations"; the influence upon him of the new anatomy that permeated the atmosphere of Padua and of Galileo's ideas on motion, later intensified by the Baroque era, which was characterized by motion; and, finally, the inner meaning of his scientific vocation.

When Harvey arrived in Padua the air was charged with the *nova scienza*. Fifty-four years earlier Vesalius' *Fabrica* had burst like a rocket upon the horizon. The illustrations by Titian and Calcar were great windows of light opening unto a new anatomy. Vesalius was now resting beneath pine trees on a remote island, but his creative spirit still lingered in the halls of Padua, where his dissections had set afire the minds of students from all Europe.

Vesalius had left a luminous legend among the students. He was a man of mystery who did much and said little. They still spoke of his noble figure when, on December 5, 1537, amidst great blowing of trumpets, waving flags, towering plumes, cloaks of purple velvet, and glittering swords, he was made a physician at the palace of the Bishop of Padua. The next day he was appointed professor of surgery. The students also recalled the famous trip to Basel across the snow-blanketed Alps, the huge wooden blocks of the *Fabrica* balanced precariously on the back of plodding mules. In Basel they yielded the pages that committed to dust Galen's theories.

But if Padua throbbed with the memory of the heroes of the new science, it also crawled with quacks. There were physicians who earned the freshly minted gold *zecchini* by washing with aromatic vinegar the dead bodies of the rich, wrapping them in linen soaked in essence of aloe, and burying them in lead caskets enclosed in caskets of cypress wood. Other physicians roamed the streets garbed in grotesque costumes devised to protect them from the plague. Some wore long beaks, filled with protective aromatic essences, which gave them the appearance of huge birds. And there were physicians like Tomasso Gianotti Rangone who taught people "how to live 120 years."

Money flowed in Padua. Magic and alchemy were still rampant. Dreaded fevers lurked in the still waters of lagoons and rivers. Typhoid fever, typhus, and plague killed 999 out of every thousand patients. There were more than 100 apothecaries in town, and every one of them featured theriac as a miraculous all-purpose antidote.

On the other hand, Padua had already adopted the Venetian legislation against plague. The dead were buried outside the city, and houses were disinfected with sunlight and sulfur vapors. There were plague physicians easily identified by the small white baton they carried; and a certificate of good health was required from travelers.

THE GIANTS—FABRICIUS AND GALILEO

Such was the atmosphere in which Harvey now moved. He studied under Casserio and Ridio. He learned from Fabricius of the existence of the venous valves, which would later move him to study embryological and physiological problems. The venous valves were discovered in 1546 by Canano (by Sylvius, according to Riolan), but Fabricius was the first to describe them in his little book *De venarum ostiolis*.

Fabricius observed experimentally that the valves of the great femoral and brachial veins slowed down the movement of the blood from the base of the limbs to the peripheral regions. Fabricius, therefore, almost hit upon the concept of the major circulation. But the Galenic influence upon him was too strong, leading him to conclude that the function of the *ostiola venarum* was "to slow down the blood so as to prevent it from flooding, like a river, now the feet, now all the fingers of the hands, and becoming stagnant in those areas, which might cause two alterations: the upper portions of the limbs would be working, while the hands and feet would be asleep due to perpetual tumefaction."

Harvey was in Padua when Fabricius published his first physiological works, investigated the formation of the chick in the egg and of the human embryo, and challenged the doctrine of spontaneous generation that affirmed that animals developed from an egg. This triple influence—anatomical, physiological, and embryological—had a tremendous impact on Harvey, who was one of Fabricius' favorite pupils.

The controversy that arose in Padua in 1600, when the Galenist, Eustaquio Rudio, professor at the university since the previous year, reprinted his work of 1587 describing the lesser circulation and commenting on the texts of Colombo and Cesalpino on that subject, gave Harvey an impassioned vision of the still unresolved problem of the motion of the blood.

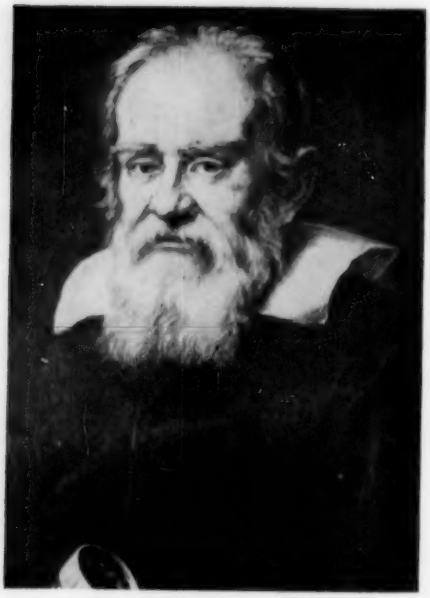
Fabricius ab Acquapendente (1533–1619).

To this impact was added that of Galileo's work. In those days Galileo initiated modern physics and the science of dynamics. Galileo had studied medicine and mathematics at Pisa. In the leaning tower of Pisa, that huge paperweight seemingly holding down the landscape so that the strong regional winds may not blow it away, Galileo conducted his famous experiments, demonstrating that velocity is not proportionate to weight. Galileo was appointed professor of mathematics at Padua in 1592, at the same time that Copernicus was studying medicine with Fracastoro, who gave syphilis its poetic name.

While Fabricius demonstrated anatomy, Galileo expounded his theories on mathematics and physics to vast audiences in the amphitheatre of the School of Law. Kings and aristocrats attended, and among the medical students again we discover the eager face of Harvey.

As was the custom then, students boarded with the professors, and in the evening Harvey joined those who lived with Galileo and together they spent many hours either discussing the mysteries of physics with Galileo and the erudite monk, Paolo Sarpi, who helped to discover the venous valves, or observing through Galileo's telescope the stars, brilliant, enigmatic, like the eyes of thousands of celestial cats, in the skies of Padua.

Galileo must have spoken to Harvey often about the movement of the stars and



Galileo Galilei (1564–1642).

the heavenly bodies, and surely Harvey must have asked him many questions about the laws of motion. How many hours Harvey must have spent also looking through the microscope constructed by Galileo! What thoughts filled his mind on his way back to his lodgings after an evening with Galileo? Perhaps sometimes he stopped at a *trattoria* to sup on the popular porcupine, which was eaten only from October to January when its odor was less offensive. Was he ever aware of the hot sauce, concocted with garlic, rosemary, mint, wine, vinegar, pepper, and cinnamon, with which they tried to disguise the strong flavor of the meat, or was his mind too occupied with the startling concepts he had heard all evening to notice such trivial things? Back again in his modest room, his head spinning with thoughts of motion, perhaps he found it difficult to induce himself to sleep.

THE HISTORICAL CRISIS OF THE RENAISSANCE

The Renaissance was a great historical crisis.

There are two kinds of historical changes. One affects the whole world; this is normal in every generation. The other affects something in particular in our world; this is a historical crisis. When one system of convictions crumbles down but is immediately replaced by another, there is no room for a crisis. But when no replacement is forthcoming, when man is left without convictions, which is to say, without a world, then man is in crisis. His world has been demolished. There are no new beliefs to replace the old ones. Man then feels lost, disoriented, disconcerted. Often

at such times a whole generation may deceive itself by becoming engrossed in doctrines, arts, or politics that are not its own, only to disintegrate if by the time it reaches the age of 40 it has not developed its own convictions. For at that age it is imperative to live by Truth.

The Renaissance was a rebirth in general history though a true birth in science. Back in the Middle Ages, in the thirteenth century, there had been a golden age, initiated by Albertus Magnus and fulfilled by St. Thomas Aquinas. This century witnessed the great adventure of the Crusades, a complete military failure but a great cultural success, for stowed away in their battered knapsacks the defeated Crusaders brought back the priceless treasure of classical Greek wisdom, which later would Hellenize Christianity.

In the sixteenth century, man was in crisis, and he did what every man in crisis does: he undressed. When we are in a crisis we shed hat, coat, whatever may hinder action. In a historical crisis man sheds his old beliefs. This is what he did in the Renaissance. He cast off his medieval ideas. The faith he had exclusively given God he now bestowed upon things and himself. Galileo's modern physics provided him with a technical reason; the first European state of Ferdinand and Isabella with the *raison d'état*. Both these reasons were the basis of modern man's thinking. In the fifteenth century, a century without an understanding of which one cannot understand modern history, medieval man vanished like a burnt-out rocket, and modern man rose like a new rocket above the horizon.

Harvey's work was part of this historical crisis. Galenism weighed on him like shot on a bird's wing. Vesalius' anatomy had dealt a mortal blow to Galenism, but it was still a static anatomy. Much had still to be done to give it life, to make it stir and move, to turn it into *anatomia animata*. This became Harvey's youthful endeavor.

It also was his own individual crisis. All of man abhors a vacuum. Just as the human body must promptly fill up with fat and conjunctive tissue any void created by the extirpation of an organ, so must the human mind replace one truncated belief by another. Neither one can abide a vacuum. If Harvey had lived in the years prior to the Renaissance crisis, from a historical standpoint he would have felt no urge to replace the already moribund Galenism by a new scientific doctrine. But his own historical crisis was a fitting parallel to the Renaissance crisis, when the austere medieval concepts were being replaced by a new, passionate concept of life and the world.

To the influence of his teachers, both those absent like Vesalius and those present like Fabricius and Galileo, to the influence of Renaissance Padua, and to the historical crisis of his time—to these three factors must be added the longing Harvey had to create modern physiology. No other place could have offered him more encouragement than Italy.

In every historical period there are "visceral" countries, that is, countries that are the vital organs around which the rest of the world revolves, just as in the body the various organs are organized around the heart. In Harvey's time, at the height of the Renaissance and the Baroque, the "visceral" countries were Italy, England, and the Low Countries.

In one's early youth, longing for personal glory represents not so much the desire to do something great or to be somebody as the desire to *emulate* someone. The young man adopts as model a hero whom he desires to imitate and even surpass. Sometimes a whole generation or a historical period will pattern its entire course after a great figure or a great historical situation of the past. Vesalius' work no doubt was prompted by the desire to emulate Galen or Erasistratus, just as the Renaissance was the result of the desire to emulate classical antiquity in the arts and sciences. Young Harvey's models were Vesalius, Fabricius, and Galileo.

THE HISTORICAL ADVENTURE OF THE DISCOVERY OF THE CIRCULATION OF THE BLOOD

Every human endeavor in history fits within a "line" and a "situation." The line is the vertical chronology of all preceding endeavors of the same nature; in Harvey's case, for example, everything done on the circulation of the blood prior to him. The situation is the environment in which the endeavor was developed and carried to fruition.

The line of Harvey's discovery, that is, the knowledge available on the circulation of the blood before Harvey, is easy to determine. The circulation of the blood had been a subject of much discussion for many centuries, from the Vedas to Galen. The old ideas on the subject, however, were wrong, and in medicine it is far more difficult to rectify an error than to make a new discovery. Such ideas were based on the fact that dissection revealed two vascular systems: one, the venous, was full of blood, produced, it was assumed, in the liver since the latter contained so much blood; and the other, the arterial, was always empty and therefore must serve, it was believed, to distribute air or vital force throughout the body. Today we know that when parietal tension in the arterioles subsides, these draw blood from the arteries, emptying them and allowing in the air when they are cut open in dissection.

It was the Spaniard, Miguel Servetus, who first described the lesser or pulmonary circulation in his nonmedical, theological work *De Christianismi Restitutio*, which only earned him the wrath of the Church. Condemned by Calvin for heresy, he was burned alive in Geneva, a sulfur-soaked bramble crown on his brow and a greenwood pyre at his feet that his agony might be prolonged. Not long ago I stood on the hill in Geneva where Servetus was burned. Charitable hands have marked the place with a stone plaque vindicating the Spanish martyr, mercifully omitting the name of his executioner. Should you ever be there at the hour when dusk descends upon the land and shadows lengthen, you will see the mists creep up the hill from the lake, evoking the martyr's shroud. And when the first quivering star appears in the faded sky you may wonder: Is it the soul of Servetus or of his repentant executioner?

Six years after Servetus' death, the Italian, Realdo Colombo, one of Vesalius' successors at Padua, published an anatomical work, filled with much sarcasm and bravado, describing, based on experiments with live animals, the passage of the blood from the right to the left ventricle and its change of color in the lungs. Colombo conveniently overlooked giving Servetus and his predecessors the credit due them.

Colombo was succeeded by Gabriel Fallopius, philosopher, botanist, academician, and personal physician to the Pope, and Fallopius was followed by Fabricius. But before Fabricius there had been one Andrea Cesalpino who came very close to the truth when he asserted that the heart, not the liver, as Galen had said, was the central organ of the vascular system. Cesalpino demonstrated that the blood moves, was the first to use the word *circulatio*, and wrote that the movement of the blood is continuous from the veins to the heart and from this to the arteries, a concept that the Spaniard Valverde would formulate again later. Cesalpino believed that during sleep the blood traveled from the arteries to the veins and thence to the heart; but like Galen he maintained that there was a continuous and direct flow of blood through the interventricular septum.

Later, Fabricius discovered the venous valves, tiny membranous folds or pockets inside the veins, which he interpreted as a confirmation of the concept that the blood moved from the center to the periphery. This physiological error would later be dispelled by his pupil Harvey.

Day after day Harvey must have watched his master tirelessly demonstrating on the dissecting table his favorite theme—the valves or "the little doors of the veins"—and perhaps at some time or another the thought may have crossed his mind that the valves might very well indicate exactly the opposite of what the master claimed, that is, that the blood coursed through the veins from the periphery to the center. Fabricius' absorbing interest in the valves must have stirred Harvey's interest in the problem of the circulation of the blood, an interest that must have been further stimulated by the anatomical spirit that permeated the University of Padua. To be a student in Padua in those days meant becoming interested in anatomy for life. This is what happened to Harvey.

LINE AND SITUATION OF HARVEY'S WORK

This, then, was the line in the history of medicine of Harvey's work. What was his situation in the history of the human spirit? Harvey was a man of both the Renaissance and the Baroque. His Renaissance spirit explains his interest in anatomy; the Baroque explains his interest in movement.

According to Ortega y Gasset, every historical situation comprises two strata in the life of man: one involves his *principles*, the other his *expressions*. His principles consist in his beliefs and intuitions about God, himself, and the world; his expressions are the ways in which his principles are objectively translated into political, economic, artistic, or scientific realities.

The Renaissance was a time of crisis, of transition from the medieval conception —Christian and Gothic—of the world to a new, modern conception that was naturalistic and Baroque.

Vesalius, primarily a Renaissance man, had a "closed" tectonic conception of the human body that enabled him to represent from the outside what was inside the body. Harvey, who experienced the impact of the new Baroque style, had an "open" conception of the human body. In art, which always heralds new trends in science, these two conceptions were expressed respectively in the massive, monumental

architectonic style of the Renaissance and the light, airy, dynamic Gothic and Baroque styles. The vertical and horizontal characteristics of the Renaissance style were changed in the Baroque into the curved line and the circle. Renaissance architecture, St. Peter's Basilica, for example, is organized around a vertical axis; Harvey's anatomy is multiple and is organized around dynamic forces. Vesalius' static and classical morphology became mobile and dynamic with Harvey. The immobile wheels in many Renaissance paintings now began to spin, as the wheel in Velázquez' painting, "Las Hilanderas." This wheel in motion is the artistic symbol of the motion of the blood in a circle that Harvey was to describe.

Such, then, was the "line" and "situation" of Harvey's endeavor. A youth of 20 years spends four decisive years in a town seething with new ideas on human anatomy and on movement. Surely these powerful forces must have exerted a profound influence on his sensitive mind?

HARVEY'S CRUCIAL YEARS

I believe that the greatest moment in any scientific discovery—when it is not a fortuitous accident but the result of determined planning and dogged work—is not that moment when the discovery is made, no matter how spectacular such moment may be, but that other moment when a man conceives a theme of universal importance and decides to devote his entire life to its revelation.

Harvey's moment of greatness, then, was not when he announced that the blood moves in a circle, but when the desire was born in his still adolescent mind not merely to describe the movement of the blood, as his predecessors had done, but to discover why and how it moved and to *demonstrate* the process. Harvey's glory, I believe, lies not so much in his discovery as in his decision to make the discovery, just as Vesalius' glory lies in his decision to rediscover human anatomy and to demonstrate it scientifically.

We can imagine Harvey at the close of his four years in Padua. He has known and listened many times to the great masters. He has shared the youthful enthusiasm and ambitions of students from all Europe. His eyes have basked in the marvel that was Venice when the armor in the palaces was not yet rusting away piece by piece, when the tapestries still glowed with brilliant colors, when tapering candles still burned in the cressets and the pink and ivory façades of the palaces were embroidered in dancing colors by the torches in the passing gondolas. He has visited the wealthy in their homes, veritable fortresses lodging small armies of *bravi*, salaried professional swordsmen and killers of such ferocious visage that even the chatelaines locked themselves in their quarters, receiving their meals through a turnstile. He has shared the tables of the wealthy, drunk their wine brought from Syria and Greece and served in glowing Murano goblets, and had his hands washed by servants in bowls of solid gold. Perhaps he has known the nocturnal Bohemia in the streets of Padua, where students caroused and rioted under a moon livid as the face of Pierrot. And he has also shared the camaraderie in the popular *trattorias* where eels were served in aspic, pork was marinated in garlic and onion, and wine was poured out of leather skins.

He has looked at the human body with scrutinizing eyes, as Leonardo recom-

mended, and has studied the heavenly bodies through Galileo's telescope. Perhaps he has hunted the deer in the 12-mile-long park of the Duke of Ferra Mesola, which boasted of a primeval forest with wolves and wild boar.

And then, saturated with the bright, passionate life of Italy, Harvey shook the sun of Padua off his cape and returned to England to fulfill his destiny.

ENGLAND IN THE SEVENTEENTH CENTURY

Harvey returned to his country possessed of a new intellectual attitude toward the problems of visible nature. The Italy that formed Galileo also influenced Harvey. Aldous Huxley said of Shakespeare that he was an English poet who wrote Italian dramas for German audiences. To a certain extent Harvey was an English physiologist who with great insight elaborated on Italian thoughts and then published his results in Germany. In contrast to the Puritan and isolationist line of Cromwell, Harvey, like Shakespeare, possessed a great liberal European spirit and therefore was a universal Englishman.

Back in England, Harvey found a different London, the early seventeenth-century London. This would be the stage for his years of initiation and assertion, just as Padua had been the stage for his early years of youth. This London had witnessed the triumphant onrush of the Renaissance and the slow infiltration of the Baroque.

The history of the seventeenth century is the history of Humanity adapting itself to a new order of things. New political and social institutions were being born. Printing and horse-driven vehicles facilitated communication between men. Gunpowder had defeated feudalism, and the compass had opened new routes overseas. Side by side with the absolute monarchies of Charles I of Spain, Henry VIII and Charles I of England, and the "Sun King" in France, there flourished religious wars and an impressive array of religious reformers and philosophers: Wycliffe, Erasmus, Huss.

The austerity of the Reform contrasted sharply with the fabulous splendor of the court of Versailles. This indeed was a fanciful world, gay, frivolous, mindful only of the trappings of the body. Sumptuous palaces glistened with gold-finished furniture and wall after wall of gilded mirrors. The elaborate gardens afforded a gorgeous setting for the towering powdered headdresses, the exquisitely embroidered tunics, the frothy ruffles of the finest lace, and the voluminous skirts of rich silk, velvet, and satin. Spain lost her place among the world powers, and Russia, under Ivan the Terrible and Peter the Great, became acquainted with the Occidental world. Merchants and industrialists were creating capitalism. The concepts of nation, social classes, state, and balance of power were gradually developing. Great philosophers flourished—Descartes, Leibnitz, Bacon, Locke; and great physicists—Kepler, Newton, Galileo; and great artists—Shakespeare, Cervantes, Lope de Vega, Calderón, Rubens, Velázquez, El Greco. Political power was held first by the Spaniards, then by the French, and finally by the English. Symbols of these changes were the *hidalgo*, the *honnête homme*, and the gentleman, successively.

The severe tensions and contrasts of this period between democracy and absolutism and between reason and the religious fanaticism, which sent Giordano Bruno and

Campanella to their deaths and forced Galileo to retract his theories, were reflected in medicine. The general practitioner felt bewildered and lost when the old edifice of Galenic doctrines tottered and crumbled down and not one but hundreds of complex theoretical structures sprang up. And since every new faith is reflected first in art, Baroque art expressed far more faithfully than any other field the new dynamic concept of the world and life.

PROFILE OF THE BAROQUE

The term "Baroque," which is derived through the Spanish and Portuguese from the Arabic word *buraq* used originally by jewelers to describe irregularly shaped pearls, designates the style of art and architecture that prevailed in the seventeenth century, characterized chiefly by excessive ornamentation and the tendency to portray movement and expression. The term was later extended to include all the culture of this period. The Baroque style, born in Italy, manifested a preference for curves instead of straight lines. Curves were more dynamic and lent themselves better to the representation of emotion and action. The style had such exponents as the Italian decorative painters and architects Colonna, Mantovano, Algardi, and Bernini and the painters Correggio, Mantegna, Tintoretto, and Paul Veronese; the Flemish painters Rubens and Van Dyck; the Dutch painter Franz Hals; the Spanish painters El Greco, Velázquez, Murillo, and Zurbarán. In this period artists suddenly focused their attention on the world in its infinite mobility. Sculpture acquired a fierce mobility and pillars became intricate spirals. Michelangelo was the greatest exponent of this new style.

Rebellion against Protestant austerity was translated into a display of emotions and ornamentation of flood proportions in art. Figures acquired cyclopean dimensions, every line and fold overtly and even fiercely expressing emotion of some sort. There are many examples of this in Michelangelo's work and in the piazzas in Rome, the Fontana de Trevi, for example. Ceilings were heavily decorated, walls were lined with rich damask, beds were intricately carved, mirrors in heavily gilded frames glistened everywhere, and the façades of churches and palaces became veritable labyrinths of filigree work.

In England, except in literature and drama, the Baroque style failed to grow deep roots. The Roman topiary art (the decoration of gardens with ivy and box trimmed to the shape of animals, persons, or tableaux) was revived and, during the transition from the Tudors to the Stuarts, architecture was improved, although not much building was done during the 10 years of Cromwell's protectorate. The great London fire of 1666 destroyed the last remnants of medieval architecture, and lighter woods, particularly walnut, became popular and the new constructions were far lighter.

All in all, the Baroque was synonymous with emotion, ornamentation, and movement. These three trends were reflected in the literary work of Browne, Bunyan, Hobbes, Milton, Lovelace, and Shakespeare, and also in medicine, in the work of scientists like Harvey.

Upon his arrival in London, Harvey revalidated his title of Doctor in Physic, received in Padua on April 25, 1602. He was in London when Queen Elizabeth died

and James I ascended the throne. The following year he joined the Royal College of Physicians, and in 1604 married Elizabeth Browne, daughter of Lancelot Browne, physician to James I, going to reside at St. Martins, Ludgate. In the next year his mother died at the age of 50 at Folkestone, and also his father-in-law.

ISOLATION AND CHASTITY OF THE SCIENTIST

The love life of the scientist is generally routinary and uniform. With few exceptions the great artist or scientist, like Velázquez or Harvey, leads a tranquil life even in the love arena. In their lives there is no room for great passions or love adventures. For scientific investigation cannot be conciliated with great amatory activity. Casanova's continuous erotic life, for instance, would have made sustained scientific thought impossible.

There is one other reason. The scientist is often shy sexually. Research is a sexual equivalent of other activities and becomes a passion whose intensity and pleasures equal or surpass those of love. Sexual energy is sublimated into longing for knowledge and to create. This is what happened to Harvey, whose private life is as much a mystery as Shakespeare's and seems to have been dedicated exclusively to research.

His first years in London Harvey spent between research, his childless home, and St. Bartholomew's Hospital, where he attended the victims of the plague. In 1613 he was appointed Censor of the Royal College of Physicians and in 1615, Lecturer, with the duties and salary corresponding to those of a professor of physic, at the Colleges of Oxford and Cambridge.

In these same years there were great historical happenings. In 1609 Henry Hudson anchored the *Half Moon* in the Hudson River; in 1611 King James' authorized version of the Bible was published; the tide of Puritanism was gaining momentum; the friction between the King and Parliament increased. And in April, 1616, exactly 341 years ago, Harvey, at a lecture at the Royal College of Physicians, revealed for the first time his great discovery.

But before we speak further of this discovery, we must consider the historical scene in which it developed, the London of the early seventeenth century, the influence that the Baroque exerted on it, and in what consisted the glory of Harvey.

We often think of a famous scientist as if he had lived in splendid isolation, completely absorbed in the task of creation and discovery. We forget that beyond his worktable the whole world continued making history, and that he as a human being was influenced and moved by the ideas and forces that prevailed in his time. To understand Harvey's achievement, he must be looked at not as a lone figure but as one among the many who peopled the tapestry of seventeenth-century England.

Just as one cannot appreciate the painstaking work that went into the making of an embroidered Chinese tunic unless one turns it inside out and observes the labyrinth of threads wherefrom emerged the exquisite dragons and lotuses on the right side, neither can one understand Harvey's achievement unless one knows something about the seething, turbulent London that was the reverse to Harvey's quiet, silent life of research and discovery.

The city of London in Harvey's day.

LONDON IN 1602

It is 1602 in London, the year of Harvey's return. The first strains of the Baroque are already subduing the impact of the Renaissance on the city. To understand Harvey's personality and work, we must understand first the ever-changing scene in which his life developed.

These were the great years, turbulent and rich in creation, of England. When Harvey was born Elizabeth was Queen. When he was 10 years old, he must have seen his neighbors in the streets of Folkestone commenting with much excitement on the defeat of Philip II's Invincible Armada by both the elements and the English cannons on the steely waters of the Canal de la Mancha. Harvey's first few years in London coincided with the relatively peaceful reign of James I, whose court afforded eager shelter to frivolity and sybaritism. Great must have been the contrast between these gay years and Harvey's later years, during the reign of Charles I, when civil war broke out, bringing in its bloody wake great changes in the history of England!

But parallel to the bloody violent changes there could be perceived an intellectual renaissance, a natural sequel to the spiritual greatness of the Elizabethan era. English genius flourished everywhere. Bacon and Newton gave science fresh impetus; Shakespeare and Spenser burnt with the flame of creation; Milton's *Paradise Lost* and

Bunyan's *Pilgrim's Progress* were published. Bacon was a patient of Harvey, who employed the Baconian method expounded in *Novum Organum*, although Bacon died two years before Harvey published his immortal discovery.

The major social change in England at that time was the Empire's expansion overseas. It was the great era of iron men and wooden ships. The air was filled with voices urging greater technical progress. The woolen and silk industries prospered, opening a path for cotton. Inventors sprouted all over England, soliciting extravagant patents—"a hydraulic cabinet for sending men to sleep," "an improved fish-call," to mention only two. Meanwhile, the country seethed with ferment and slowly prepared for the next civil war.

What caught Harvey's eyes as he crossed the streets of London on his way to St. Bartholomew's Hospital?

London was shabby and noisy, but the shabbiness was gay like that of the pert urchins who sold fish by the Thames. The streets were lined with pubs and shops, and atop the doors the signboards with their colorful names swung merrily in the breeze. Street corners were provided with water pumps, and for those who refused to stand in line there were "cobs," or water-carriers, peddling water from great barrels.

There were also "stocks, pillory and cage at Cornhill" and "cucking-stools for scolds" along the Thames. Those with a morbid taste could promenade to the London Bridge and watch the heads of traitors swinging in the air, their faces still distorted by the last death spasm. In 1598, the year Harvey went to Padua, 30 heads of traitors swung at once like death bells from the bridge tower.

The women who passed Harvey on the streets had faces like frosted apples, the skin pale, the cheeks pink. The rest of the body was concealed under stiff peaked bodices, adorned with ruffs after the Spanish style, and the monstrous wheeled farthingale, consisting of an enormous circular skirt gathered at the waist and stretched out around the hips over a large hoop reaching down to the ground. Under the enormous beplumed hats, they wore a small French hood to restrain the masses of curled hair. The wives of citizens were obliged to wear white knitted caps of woolen yarn, unless their husbands could prove themselves gentlemen by birth. The men were dressed in trunks, which consisted of very short stuffed breeches and trunk hose, and their shoes had heels. Later, under James I, court ladies wore masks in public, and the men allowed their hair to grow long and replaced ruffs by large lace collars and cuffs. Great whiffs of perfume must have reached Harvey as a woman crossed his path, for perfume was used profusely as a preventive against the plague that devastated London in 1602 and killed 41,313 persons in 1625 alone. Even men carried pomander-chains of civet and musk and a casting bottle of perfume, as well as a mirror in the hat or elsewhere.

Harvey, a sober man all his life, must have shied away from the large elaborate dinners that were customary in those days. The gentry dined at 11 in the morning, dinner lasting three hours, and they supped at 6 in the evening. Merchants and farmers dined at noon and supped at 7. Meat was consumed in excess, mainly being roasted on the spit. Baking was done in iron boxes placed in the fire or in a brick oven at the side of the fireplace. China was not used. The poor used wooden

utensils, which later were replaced by pewter; the wealthy used silver, glass, and delftware.

Sugar was replacing honey, rum was already known, and gin was beginning to be made. The high protein diet—salt fish and salt meat, turkey, venison pasty, whay, hog's harslet (from a pig's inside), chicken, lobster, some potatoes, and salads and asparagus—was the cause of numerous skin and vitamin-deficiency diseases, as well as of gout, which plagued most of the great figures in English history and the rich people.

The men of fashion had adopted the new diversion of smoking, which, then as now, was a subject of great controversy. These fashionable gentlemen lived a life of leisure and pleasure, the lack of physical exercise sharply contrasting with the excess of activities in other fields. They never walked, lest they should soil their highly polished boots in London's mud-padded streets, depending exclusively on horses, carriages, and boats. Much time was spent in having the shoes shined to resemble mirrors and the hair groomed and curled into the lovelocks then so fashionable.

A gentleman's typical day usually consisted of chess in the morning, cards after dinner, then dice to exercise his arms, or tennis to exercise his body, or perhaps backgammon, shuffleboard, or billiards, after which he would repair to the theatre or a social gathering.

One may safely assume that Harvey was the antithesis to these useless lives, which indubitably were one of the reasons for the Puritan reaction, and that the sight of these pleasure-seeking, time-wasting creatures must have spurred even further his longing to do something in the field of medical science.

HARVEY AND THE BAROQUE

Harvey returned to England thoroughly imbued with the anatomical teachings of Padua and Galileo's deductions on the movements of the heavenly bodies. Two themes were constantly to revolve in his mind in the years to come: anatomy and movement, which would eventually culminate in his great *anatomia animata*. Thereafter he would be completely absorbed by a third idea: the application of his concepts on movement to the blood. Harvey's one goal, then, was to develop an animate anatomy of the blood, an anatomico-physiological theory on the movement of the blood.

We have mentioned the source of inspiration for Harvey's concept of movement, basis of his physiology and of modern physiology. Never can one insist enough on the vital influence exerted by the so-called "spirit of an epoch." It is easy to understand today's miraculous progress in microbiology and antibiotic research if we relate it to atomic science, which in disintegrating the universe has equally affected everything else, as borne out by modern art, a fragmentary and disintegrated art, and by modern political philosophy, which has tended to atomize the old concept of nationalities. And so is Vesalius' architectonic anatomy related to the architectonic style of the Renaissance; and detail-loving Byzantine medicine to the precious miniature work on the mosaics of Ravenna and Constantinople; and the flattened

anatomy of the Egyptians to their flat and bidimensional reliefs; and the progress in microscopy in the Romantic period to the yearning for infiniteness embodied in their romantic poetry.

Man's life generally spans one period in history, and his activities, even the meaning of his endeavors, are determined by the cultural currents of his period. Harvey was a Renaissance man straddling on the incoming edge of the Baroque, and if we fail to bear in mind that it was the Baroque period, we simply deprive his magnificent obsession with movement of its historical meaning.

The Baroque was essentially an explosion of movement. Art became dynamic. Spiral columns soared into space, replacing the old classical columns, and the stone of cathedrals and palaces was wrenched from its mystic Gothic placidity and turned into veritable whirlpools. Harvey's mental chemistry must have reflected the spirit of the epoch, the new animated view of nature and life, inducing him to leap from Vesalius' static anatomy to the *anatomia animata*, today called physiology. And it also inspired his embryologic discoveries, which were simply another form of creating animate anatomy in time, just as his physiology did in space. The yearning to impart movement to everything in existence that pervaded the Baroque period was the philosophical inspiration underlying Harvey's discovery that the blood moves and that it does so in a circle.

THE SECRET OF THE CIRCLE

This notion of the circle is philosophically of great importance. In a letter to Dr. Brengger, dated 1608, the physicist Kepler said: "I learned from Wacker that Bruno was burnt in Rome and that he suffered with fortitude, asserting the vanity of all religions and the identity of God with the world, the circle and the point."

This résumé of the thought of Giordano Bruno, the immortal philosopher, symbolizes Unity in the circle, the Eternal Being who is active and immutable against the constant variety in ever-changing phenomena. For Bruno, the circle—as pointed out by Walter Pagel—was the whole and a part, beginning and end, central point and circumference, the root of all other geometrical figures.

Every movement that returns to its point of origin must adopt the form of a circle. Only circular movement is continuous and consistent. Every object of nature is, then, a circle, whose function and activity derive from its center point, which is the soul. From the soul the active principle tends, according to Bruno, to go to the periphery, whence it flows back to the center.

Harvey's discovery, therefore, is bound to a philosophy of circles, and the circular motion of the blood is a microcosmic example of a macrocosmic pattern, it being the cycle that conducts the process of return to its point of departure, a phenomenon that Harvey also identified in his studies on generation.

This cosmological viewpoint is expressed in a passage by Giordano Bruno that, referring to the air and "spirit" of which the blood is vector, says: ". . . there is no circular or spheric motion outside the body. For the blood which in the animal body moves in a circle in order to distribute its motor, the spiritu lies motionless outside the body, is inert and decays, no longer deserving the name of blood." ("*Sanguis*

enim qui in corpore animalis in circulum movetur . . . .") This extraordinary passage is from *De rerum Principiis*, published 250 years after Bruno's death, the original manuscript bearing the handwritten date of March 16, 1590. In Bruno's treatise *De monade numero et figura* (Frankfurt, 1591) specific mention is made of the circular movement of the blood.

This is vastly important because Giordano Bruno could have been the philosophical link between Cesalpino, the first to use in 1571 the term *circulatio*, and Harvey. These three men had in common the fact that they used an Aristotelian cosmology. Cesalpino even demonstrated as best he could the path followed by the blood from the veins to the heart and then through the arteries to the periphery. This, however, takes no glory from Harvey. Bruno, with that intuition innate in most artists and philosophers, perceived a scientific truth that he neglected to demonstrate. For Harvey, on the other hand, the essential thing was not that he had discovered the circulation of the blood, but that he could *demonstrate* it. The urge to demonstrate scientifically that which others were content to accept as a mystico-philosophical truth based on the concept of the circle—this urge alone—marks him with a seal of glory.

And now let us examine briefly one other aspect of the times of Harvey that is more than mere coincidence. I refer to the intellectual relations between Shakespeare's work and Harvey's, between the scientific vision of the poet and the poetic conception of the scientist.

THE THEATRE IN LONDON IN HARVEY'S DAY

Love for the theatre was enormous in Harvey's day. The public enjoyed immensely the masques, which were spectacles with music, dancing, beautiful lighting effects, and a wide variety of scene changes. But above all they enjoyed the legitimate theatre. In the 10 years preceding Shakespeare, 1580 to 1590, a group of dramatists called the Bohemians, including such figures as Marlowe, Peele, Greene, and Nash, held sway in London's theatrical world. In Shakespeare's time, 1585 and on, plays were performed in galleried yards of inns, which were also used for bear-baiting and wild beast shows. There were three proper theatres, the "Swan," a rather "grubby" place, the "Rose," and the theatre in Shoreditch. Shakespeare had his own theatre called the "Globe." All the theatres were closed during the plague. The scenery was rather rudimentary and sometimes there was none; there were no actresses, only male actors; plot and action were the most important elements. Hence the reasons that Shakespeare's plays are crammed with action and violence.

It is pleasant to imagine Harvey crossing the Thames on his way to the Globe to see perhaps the opening of *Hamlet* in 1602, of *Othello* in 1603, and of *Macbeth* and *King Lear* in 1606.

SHAKESPEARE AND HARVEY

In no other plays in the entire history of the theatre have the words "blood" and "heart" been quoted as often as in Shakespeare's plays. Shakespeare's dramas are as Aristotelian as Harvey's work. They proclaim the central and basic role of the

A representation of a Shakespeare play at the Globe Theatre in London in Harvey's day.

heart. One can visualize the slight little doctor, his hair black, his eyes deep and dark, his nervous fingers forever stroking the pommel of his dagger, sitting at the Globe many an evening listening to the violent voices that spoke of blood and the heart. "By the soul that guides me and the heart that beats in me, I shall never succumb to doubt," Macbeth said; and Hamlet spoke of the passage of blood through the canals of the body.

In Act I, Scene 1, of *Coriolanus* (1609), Menenius tells the citizens who have complained of hunger a fable comparing the body organs with the State organs, "the belly" being the officers who collect food and distribute it to the needy ones, just as the blood circulates through the body, feeding all parts: "But, if you do remember I send it through the rivers of your blood Even to the court, the heart, to the seat o' the brain And, through the cranks and offices of man, The strongest nerves and small inferior veins From me receive that natural competency whereby they live."

Shakespeare died before Harvey announced his discovery, but once more the poet's marvelous intuition not only anteceded the scientist's confirmation, but perhaps also contributed to give meaning to his work.

HARVEY'S EXPERIMENTAL METHOD

Such, then, were the forces that influenced Harvey's restless mind in his London years, filled with patient labor and mercurial hope. Little we know of these years

of Harvey's life. Anatomy was taught, in a rather crude manner, by barber-surgeons and at the Royal College of Physicians. There were no hospitals or medical schools in Scotland, and physicians traveled to Italy and France and later to Holland to study.

Harvey's daily life in these years (until 1615) was absorbed by his professional practice; but his inner life was absorbed by the memory of Realdo Colombo's doubts of the Galenic concept of the circulation and by Fabricius' discovery of the venous valves. He was not interested, like Galen, in the substance of the blood, but *in its movement in space;* nor was he interested, like Vesalius, in the static form, the anatomic architecture, but in animate architecture, in physiological movement. He had a Faustian concept of science. Above all, he was the first to apply to medicine two elements completely new in the history of science, having been discovered by Santorio only 14 years before—mensuration and calculation. Harvey successfully introduced the method of quantitative mensuration, which thereafter would replace the old qualitative impression. Although Harvey developed the method in his youth, like many other scientists before him, from Claude Bernard to Cajal, he did not comment on it philosophically until his later years, when meditation replaced experimentation.

Obsessed by the passion for movement of the Baroque, Harvey devoted himself to the investigation of the two movements that persist in the human being from birth until death: the pulse and respiration. The pulse is an expression of the movement of the blood, which Galen explained by saying that the food ingested was elaborated and converted into blood in the liver, and that it was then carried throughout the body by the vessels in a mysterious ebb and flow, and that the blood passed from the right side of the heart to the left through "pores" in the interventricular septum. The blood, furthermore, received at three points—the liver, the heart, and the brain —"spirits" that controlled the vital functions, and the blood went from the heart to the lungs to eliminate therefrom all residues, and the air went from the lungs to the heart to give it pneuma. Since dissection did not reveal the "pores" in the heart, Fabricius investigated in vain this mystery, which Fracastoro admitted was known solely to God.

Harvey used only his senses (did not Cushing say that all that is needed for scientific research is "running water and an idea"?) and some 80 different animals, which he vivisected, studying the heartbeat in vivo. The first problem Harvey wanted to resolve was *how much* blood is pumped by the heart during systole, a question that did not even cross the mind of the old physiologists. This question alone was a stroke of genius.

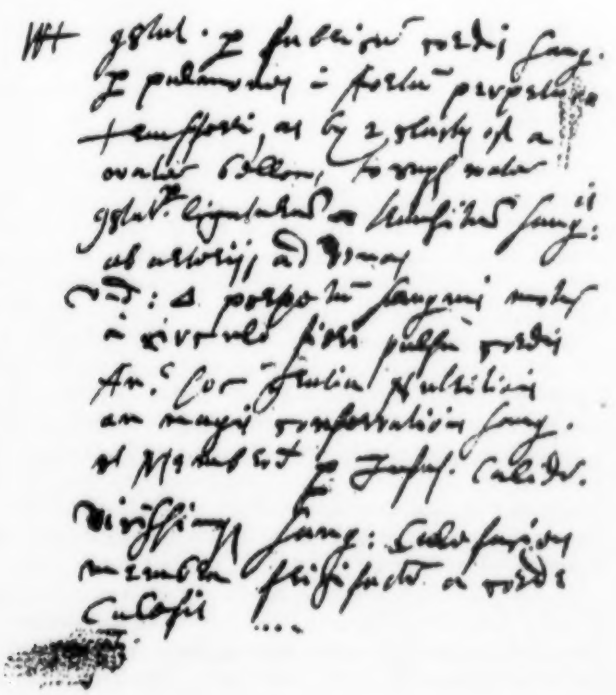
Harvey reckoned that the amount of blood was 2 fluid ounces, and that since the heart beats 72 times per minute (4300 per hour, more than 100,000 per day, and more than 37,000,000 per year), in an hour it pumped 43.2 liters (8640 fluid ounces), that is, three times the weight of an average adult. But where did all this blood come from? It certainly could not come from food and it could not be replenished hour after hour. And where did the blood go? It could not go to the tissues, for these would certainly burst under the pressure of so much blood. There was only one answer. The blood flowed from the heart to the arteries and then back to the heart. But how? There was only one logical way—through the veins.

The next step was to demonstrate that the blood in the veins circulated *toward the heart*. By firmly squeezing a cylinder in the hand and pressing with a finger on the forearm veins it was possible to observe that the venous valves prevented the centrifugal flow of blood in the veins, that is, from the heart outward. Thus Harvey completed the circle. Not only did he discover the circulation of the blood, but, what is even more important, he demonstrated it scientifically by means of mathematical reasoning, a completely new approach in science.

The long years of patient and painstaking dissection of deer, fish, snails, frogs, reptiles, birds, as well as the bodies of executed criminals, were more than amply compensated by the brilliant result, which justifies the words Harvey wrote for a student of his, De Clarges, who collected autographs: "*Dii laboribus omnia vendent*" ("The Gods will sell all for the price of work").

Harvey's great personality is reflected not only in his discovery but also in his method, the famous scientific Harveian method, based on *observation*, *reasoning*, and *experimentation*, exactly the opposite of the authoritarian, dogmatic method of his predecessors. Harvey's method initiated the mensurative approach in medical science, basis of all modern research.

These ideas were the sum of Harvey's notes, scribbled in an unintelligible handwriting, for one of his lectures in the memorable year of 1616. Later, in 1628, they



The first notation of the discovery of the circulation of the blood, in Harvey's handwriting, on the *Praelectiones anatomicae*.

were comprised in a little thin volume, published in Frankfurt under the title of *Exercitatio de motu cordis*. The small volume, teeming with printing errors, changed the face of Medicine.

ON THE EVE OF GLORY

In 1615 the College of Physicians encharged Harvey with the anatomy course, founded in 1581 by Lord Lumley and Dr. Caldwell, called the Lumleian Lectures. The course consisted in two weekly lectures all year round and one annual public "anatomy" lasting five days, "as well before as after dinner."

Harvey gave his first lecture on April 16, 1616, exactly 341 years ago, one week before Shakespeare's death. The notes he prepared for this *Praelectiones anatomicae* are preserved at the British Museum in London.

Let us visualize Harvey preparing his notes. Perhaps evening is drawing near and the last rays of the retiring sun sneak through the double arched window and mint the floor with gleaming gold. There is a table and on it a bookstand with a huge book and a bronze candelabra. A man dressed in black, his pale face resembling Shakespeare's, is scribbling some notes. His quill traces strange-looking characters in a mixture of English and Latin. The letters are like ants swarming over a musical pentagram. The man's black garments contrast sharply with the sparkle the late sun draws from the rings on his fingers. His face is angular, his hair short, his beard short and gray, and his moustache sad-looking. His eyes are two black diamonds, the sparkle of which Van Dyck would later capture in a portrait.

What occupies Harvey's thoughts? Perhaps he remembers Padua. Perhaps he sees once more the ill-lighted little room and the hard bed where he spent the nights studying; and he sees the amphitheatre with its wooden benches, where by the flickering light of the candelabras he watched Fabricius dissecting; and there are the star-studded skies of Padua again and Galileo by his side trying to solve their mysteries. The streets of Padua are burning with sun; the capes of the students flare out in the breeze; a beautiful Venetian girl crosses the piazza ahead of him and her graceful torso is silhouetted against the fresh blue of the sky and the time-worn blue of a Byzantine basilica. On its façade the pigeons form a quivering, feathered frieze.

Maybe he also remembers Galen, whom he will mention in his lecture, and Vesalius, the musketeer of anatomy who with his scalpel for a sword fatally stabbed the dogmatic authority of the classics. He thinks of the long years of work, and of Shakespeare's plays, and of the whirling spirals of the Baroque, and the many hearts of animals beating under his pallid fingers. And he feels the beat of his own heart moved by the conquest of Truth. He remembers the title of Doctor in Medicine granted him in Padua, and he can see his *stemma* or coat of arms on the ceiling of the honor hall at the University of Padua, one hand holding a lighted candle with two snakes coiled around it.

His past has filed before his eyes. His future is veiled in hopes. And he pens the immortal lines for his lecture: "*Consta per ligaturam transitum sanguinis ab arteriis ad venas, unde: perpetuum sanguinis motumin circulo fieri pulsu cordis.*" The blood moves and it moves *in a circle!* In this hour Harvey crossed the golden threshold to greatness.

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SYMPOSIUM ON MEDICINE AND WRITING

The Symposium on Medicine and Writing that appeared in the November 1956 issue of International Record of Medicine has been published recently as a Monograph. The articles included in this Monograph are: "The Editing of a Modern Medical Textbook" by Russell L. Cecil; "Plain Talk and Clear Writing" by Morris Fishbein; "The Principles of Bibliographic Citation" by John F. Fulton; "The Art of Communication" by Joseph Garland; "On Writing a History of Medicine" by Douglas Guthrie; and "Minerva and Aesculapius: The Physician as Writer" by Félix Martí-Ibáñez.

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The Life of William Harvey

1578. Born at Folkestone, Kent, on April 1, son of Thomas (a town official) and Joane Hawke Harvey, eldest of seven sons.

1588. Defeat of the Spanish Armada. Harvey entered Canterbury Grammar School this year.

1593. Entered Caius College, Cambridge, suggesting possible medical career. Caesalpinus (1524–1603) published *Questiones Medicae*, incidentally discussing pulmonary and systemic circulation.

1597. Received Bachelor's degree from Cambridge. Expedition of Earl of Essex and Sir Walter Raleigh against the Spaniards.

1598. Began medical studies at Padua, scene of the triumphs of Vesalius, R. Colombo, Fallopius, Fabricius of Acquapendente, Casserius, Galileo, Sanctorius. Fabricius had just erected a new anatomical theatre, and Harvey was one of his favorite pupils, even helping in experiments. Harvey also studied under Casserius and attended classes of Galileo.

1600. Elected *conciliarius* of "English nation" at Padua. Fabricius published his *De formato foetu*. Girodano Bruno burned at Rome. Founding of East India Company. Gilbert's *De magnete*.

1601. Re-elected *conciliarius*. Treason and execution of Earl of Essex.

1602. Received degree of Doctor of Physic at Padua, with special notations regarding his skill. Returned to England and received doctorate in medicine at Cambridge. Shakespeare's *Hamlet*.

1603. Publication of Fabricius' *De venarum ostiolis*. Death of Queen Elizabeth, accession of James I.

1604. Having returned to England and settled in London, he was admitted a Candidate of the Royal College of Physicians. Married Elizabeth Browne, daughter of Dr. Lancelot Browne, physician to Queen Elizabeth and to James I. Lived at St. Martin's Ludgate. Plague in London.

1605. Death of mother at Folkestone and of father-in-law. Gun Powder Conspiracy.

1607. Admitted as a Fellow of the Royal College of Physicians. Settlement of Jamestown, Virginia.

1609. Obtained the post of Physician to St. Bartholomew's Hospital. Charged as Physician to "Old Bart's." Hendrick Hudson anchors the Half-Moon in Hudson River.

1611. King James' Authorized Version of the English Bible.

1613. Elected Censor of the Royal College of Physicians. High cost of living; increasing friction between King and Parliament; religious squabbles. Rise of Puritanism.

1615. Appointed Lumleian Lecturer, Royal College of Physicians.

1616. *Praelectiones anatomicae*, lecture notes, for Royal College of Physicians, written in a mixture of Latin and English, summarized Harvey's views on the circulation of the blood 12 years before they appeared in print. Death of Shakespeare and Cervantes.

1618. He became Physician Extraordinary to James I. His practice had increased and he had the Lord Chancellor, Francis Bacon, and the Earl of Arundel among his patients. Start of Thirty Years' War. *Pharmacopoeia Londinensis*.

1620. Publication of Bacon's *Novum Organum*. Puritans settle in New England.

1625. Death of King James I, accession of Charles I.

1627. Appointed Elect of Royal College of Physicians, one of eight "directors."

1628. *Exercitatio anatomica de motu cordis et sanguinis in animalibus* published in Frankfurt. Elected Treasurer of Royal College of Physicians. Birth of Marcello Malpighi. Parliament's *Petition of Right*.

1630. Journeyed through France and Spain with James Stuart, Duke of Lennox. Plagues, wars, and famines. King struggling with Parliament. Appointed Physician in Ordinary to Charles I. Jacob Primrose published first attack on doctrine of the circulation.

1632. Petitioned King to restrict sale of poisons.

1633. Traveled with Charles and Court to Scotland. Tactless aggravation of religious animosities. Drew up rules governing St. Bartholomew's Hospital, subordinating surgeon to physicians. Recantation of Galileo.

1634. Lancashire witches. Harvey examined and exonerated several suspects.

1635. Accused of malpractice by Barber-Surgeons. Autopsy report on Thomas Parr, reputed to have lived 152 years. Richelieu founded Academie Française.

1636. Accompanied Lord Arundel to Vienna. Tried to convince Caspar Hoffman at Nuremberg of truth of circulation. Visited Italy. Harvard College founded.

1637. Religious riots in Scotland. Covenanters.

1639. Went with Charles and Lord Arundel against the Scotch.

1640. Sued heirs of Lord Lumley to recover salary. Meeting of Long Parliament. "Grand Remonstrance" against Charles.

1641. Trial and execution of Strafford.

1642. Charles and Court fled London. Civil War. Harvey's quarters looted, valuable papers lost. Death of Galileo. Birth of Newton. Browne's *Religio Medici*. Made Doctor of Physic at Oxford.

1643. Retired from St. Bartholomew's. Death of brothers Matthew and Michael. Accession of Louis XIV.

1645. Elected Warden of Merton College, Oxford. Death of Brother John.

1646. Fled from Oxford with King. Returned to London.

1648. Retired to live with brothers Eliab and Daniel. Afflicted with gout. Younger Riolan publishes critique of doctrine of the circulation. War of the Fronde. Peace of Westphalia, ending Thirty Years' War, and acknowledging independence of Netherlands. Sydenham made Bachelor of Medicine at Oxford.

1649. Harvey wrote two letters to Riolan answering attack. Execution of Charles I. Cromwell subdues Great Britain and Ireland.

1650. Visited by Dr. (later Sir George) Ent, who obtained manuscript of Harvey's latest work—an investigation into the subject of generation.

1651. *Exercitationes de generatione animalium* published in London through efforts of Ent. Harvey offered anonymously to build library for Royal College of Physicians. Pecquet published account of thoracic duct.

1652. Royal College of Physicians placed bust of Harvey in new library.

1653. First English edition of *De motu cordis*. Parliament disbanded.

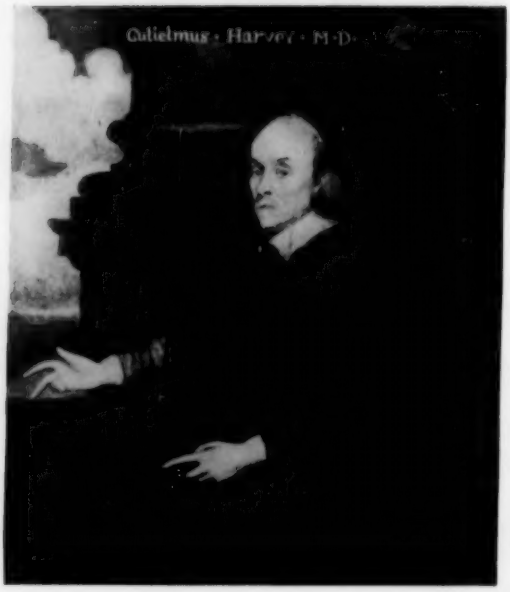
1654. Refused to accept Presidency of Royal College of Physicians.

1657. On June 3, Harvey died from gout, with terminal "palsy giving him an easy passport." He was buried at Hempstead, Essex, and in 1883 his remains were placed in the Harvey chapel in the church there.

Academy of Psychosomatic Medicine to Meet October 17-19 in Chicago

The fourth annual meeting of the Academy of Psychosomatic Medicine will be held October 17 to 19 at the Morrison Hotel, Chicago. The tentative program scheduled for the meeting will cover psychosomatic aspects of obstetrics, gynecology, and endocrinology, including diseases of metabolism; Program Chairman is Dr. William S. Kroger, Secretary of the Academy, and Co-Chairman will be Dr. J. P. Greenhill.

Representative topics to be discussed at the three day sessions include: the pre- and postnatal period, pediatrics, abortion, pregnancy, the puerperium, obesity, endocrine disease, metabolic problems, and gynecologic disorders. In addition, one full session on "Goals and Therapy" is being planned, at which the vital problems of training and education at a postgraduate level will be considered by competent authorities. Other plans include sessions on surgical stress and cancer. Round-table discussions will also be held during the sessions. Many leaders in obstetrics, gynecology, endocrinology, and psychiatry will participate in the meeting.



William Harvey: Picture Story

Left: Portrait of William Harvey (1578–1657) by Cornelius Jannssen at the Royal College of Physicians, London.

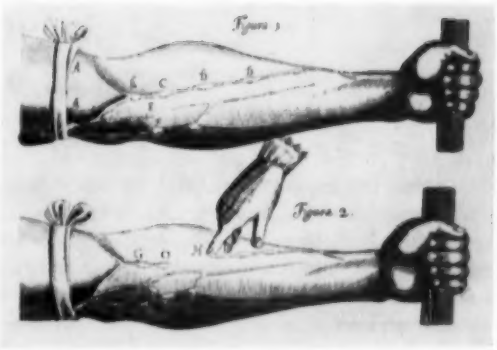
Lower Left: Titlepage to Harvey's *Exercitatio anatomica de motu cordis et sanguinis in animalibus*, 1628.

Lower Right: Copper engraving, 1651, of titlepage to Harvey's *De generatione animalium*, showing all creatures developing from egg, at a time when spontaneous generation of life was the general theory.

EXERCITATIO
ANATOMICA DE
MOTV CORDIS ET SAN-
GVINIS IN ANIMALI-
BVS,
GVILIELMI HARVEI ANGLI,
Medici Regii, & Professoris Anatomiæ in Col-
legio Medicorum Londinens.

FRANCOFVRTI,
Sumptibus GVILIELMI FITZERI.

GVILIELMI
HARVEI
EXERCITATIONES
de
Generatione Animalium.
AMSTELODAMI,
Apud Ioannem Ianssonium



Right: Harvey's experiments demonstrating that the blood in the veins circulates *toward the heart*. By firmly squeezing a cylinder in the hand and pressing with a finger on the forearm veins it was possible to observe that the venous valves prevented the centrifugal flow of blood in the veins, that is, from the heart outward. Plus making the discovery of the circulation of the blood, Harvey also demonstrated it scientifically.

Below: William Harvey demonstrating the circulation of the blood. Harvey's discovery had a mixed acceptance. The greatest opponent to his views was Riolan, who was still declaiming Harvey's findings 20 years after their publication in *De motu cordis*. However, others were recognizing and supporting Harvey's discovery, and gradually all the leading European anatomists were coming to his side. At the time of his death, Harvey was known and honored throughout Europe in recognition of his great discovery.

Traumatic Injury in Athletes

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NEW YORK, N. Y.

Athletes participating in contact sports present problems far removed from those encountered in the ordinary practice of medicine. Whereas the average individual seeks the advice and services of a physician when he thinks he is sick or actually has symptoms, and is satisfied with a gradual return to a normal state, the athlete strives for the ultimate in physical condition before he enters the "arena to do battle," and when injured, not only demands absolute recovery, but wants it faster than nature can accomplish it under ordinary conditions.

Athletes are by no means the supercreatures many people imagine them to be, even though they might at times perform seemingly superhuman feats. They are usually good athletes because they have good timing and excellent reflexes and coordination, but they may at times be suffering from some illness that may interfere with this efficiency.

In contact sports, the occupational hazards are many and diverse. Accidents and injuries frequently produce acute traumatic bruises, which may result in a disturbed reactive balance between the body cells and their environment. This disturbance can and often does result in constitutional defects or a diminished efficiency of coordination in the functions of various parts of the nervous and somatic systems. The consequence of any injury in an athlete, or in any individual, is manifested in his inability to react to conditions with his usual speed and defenses.

The fundamental physiologic reaction in any case of injury is spasm of smooth muscle, contraction of arterioles, and increased capillary permeability. These reactions are frequently complicated by pain, which may well bring about a disturbance in the body's physiologic balance. Such a break in the physiologic balance may lead to permanent tissue injury, invalidism, or even death.

The athlete is not only exposed to the hazards of injury, but he must contend with and recognize the hazards of fatigue. A body in fatigue obviously adjusts itself to environments more slowly than a body that has been rested. The sensations of tiredness, weakness, and a lessened ability to "carry on" should be recognized as complaints from the body that its functional efficiency is being impaired and its receptivity to injury is being increased. The phenomena of fatigue appear when the body's energy-yielding materials, such as oxygen and carbohydrate, are depleted. This condition prevails as long as there is the slightest inefficiency on the part of the circulatory-respiratory mechanism to deliver oxygen to all the body cells.

It is one of the miracles of nature how the body responds to correct defects caused by injury. The body marshals its forces, with every part of the body contributing its share, to compensate for and reverse or heal the injury. This mechanism is dependent on the circulation of the blood from one capillary bed to another, by way of the larger blood vessels.

The more severe the injury, the greater is the nutritional disturbance. The in-

tensity of the protein depletion and the duration of the period of this depletion will depend on the extent of the injury and the nutritional state of the individual at the time of injury. An evaluation of the patient's general condition should always precede that of his specific injury.

As pointed out by Dr. Joseph D. Wolfe, President of the American College of Sports Medicine, "Too much of our medical knowledge is based on the study of sick people, and not enough about those in good health." It is our concept that every individual, including athletes, be looked upon and considered a human being who must be maintained in the healthiest state possible if we are to expect him to carry on adequately those duties assigned to him. We are well aware that man is his own worst enemy and contributes to the development of conditions resulting in susceptibility to tissue injury. In spite of this dereliction, much can be accomplished by paying attention to nutrition, to the capillary system, and to the individual's mental attitude, and by dealing adequately with the problems of fatigue and injury when they occur.

It might be well to define nutrition in relationship to diet. Diet is a regimen of food that supports nutrition. A diet may be sufficient or deficient in foods to supply nutrition. Nutrition represents a bodily process, and tissues, for nutrition, must have essential nutrients supplied to meet requirements for structure and function. Increased requirements of tissue nutrients associated with increased muscular dexterity are evidenced by larger recommended dietary allowances. The growth of muscle tissue in the course of athletic training increases the adult requirement of protein. To ensure the utilization of protein, the diet must supply carbohydrates and fat.

Nitrogen waste may occur without significant febrile reaction in patients after injury, and this waste appears to parallel the intensity of the injury.

To condition the individual against tissue protein depletion as a result of injury that m ght be incurred n the course of competition, we prescribe protein supplement to the diet. This protein supplement (Protinal*) is a whole protein-carbohydrate mixture of high biologic value. It contains all the amino acids known to be essential to maintain life and growth. Each 30 Gm. of this mixture represents 61.25 per cent of protein derived from casein, 30 per cent of carbohydrate derived from sugar, less than 0.03 per cent of sodium, and about 1 per cent of fat.

The importance of the capillary system in health and disease has not received the consideration it deserves. As pointed out by Courville,[1] the smaller blood vessels play important and significant roles in the body, as follows. (1) They function as a part of the supporting structure of nervous tissue. (2) They function as a mechanism for the maintenance of balance of blood-plasma-cerebrospinal fluid relationship. (3) They function as channels for supply of nutrition and oxygen. (4) They function as a regulating mechanism (hypothalamic center) for control of visceral function. (5) They function as a protective mechanism against disease. (6) They function as conduits for the evacuation of decadent material from focal destructive lesions. (7) They function as sources of material for repair.

* The trade name of National Drug Co. for this protein supplement is Protinal.

Normal capillary resistance is dependent on the intercellular cement substance. After certain chemical, metabolic, psychic, or inflammatory insults, this intercellular substance undergoes changes resulting in lowered capillary resistance as manifested by increased fragility and permeability.

It has been suggested that defects in the intercellular substance could be corrected by the administration of vitamin C. Although vitamin C apparently plays an important role in the formation of this substance, it was pointed out by Bronte-Stewart[2] that ascorbic acid by itself has no proved effect in combating any condition other than scurvy.

A substance isolated by Bruckner and Szent-Györgyi[3] from Hungarian red peppers or lemon juice, which was named "citrin," was analyzed to be a mixture of hesperidin and eriodictin. Hesperidin was tested in human beings and was found to increase capillary resistance in man. A concept to the effect that the utilization of vitamin C depends on the presence of hesperidin has been established[4] and has held up under critical investigation.

A combination of hesperidin, 100 mg., and ascorbic acid, 100 mg., in capsule form (Hesper-C*) represents our prophylactic measure in maintaining normal capillary resistance. One capsule four times daily is prescribed, and in case of injury this daily dose is doubled.

Athletes, just like o her individuals, have their emotional and tension states. These states can and do result in fatigue just as severe as that following intense muscular exercise. As we mentioned previously, fatigue enhances the susceptibility to injury. We have found it possible to control this condition by the use of a muscle-relaxant ataractic agent (Dimethylane†). It has been found that this drug normalizes the tense patient by acting on the autonomic nervous system with no effect on the voluntary system and with no loss of mental acuity.[5]

Procedures have been described to properly condition the individual exposed to the hazards of his environment that may result in possible injury. We will discuss only one type of injury, which is probably the most frequent in contact sports—bruises. Bruise is defined as "a superficial injury produced by impact without laceration; a contusion."[6] A bruise is chiefly a mass of damaged capillaries that allows blood to leak into surrounding tissues. This contusion may result in a local inflammatory process. Inflammation is a manifestation of severe cellular injury. The normal filtration through the capillary wall is altered with a marked increase in capillary permeability.

Celsus has pointed out that every type of inflammation is characterized by four cardinal features: redness, swelling, heat, and pain. Hunter added another feature—"loss in function"—to which Menkin added a biochemical feature.[7] Pain has become recognized as an important warning of danger to the body; however, it is not necessary to a suitable biologic adjustment. It has been established that the intensity of pain is not directly proportional to the degree or severity of tissue damage. Inflammation has the capacity to lower the pain threshold.

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* The trade name of National Drug Co. for a combination of hesperidin and ascorbic acid is Hesper-C.

† The trade name of National Drug Co. for this muscle-relaxant ataractic agent is Dimethylane.

Although capillaries will rupture under a heavy blow, even though they are of normal resistance and functioning normally, we can reason that healthy capillaries will resist damage to a greater degree than fragile ones. Once a bruise-causing blow has been struck, an injection of purified crystalline trypsin in sesame oil (Parenzyme,* 5 mg./c.c.) is given deep intramuscularly in the buttock as soon as permitted by the rules of the game. We want to stress "deep intramuscular injection," since this procedure will reduce the incidence of local injection pain and induration that frequently result from "shallow" injections.

What is the action of trypsin? Several concepts have been suggested by Martin;[8] for example, "Trypsin administered intravenously or intramuscularly acts by its transfer to the inflammatory site. The concept of plasmin activation at the site of injection no longer seems feasible, since no detectable differences in blood plasmin concentration have been found. At the site of the inflammation, trypsin functions as a depolymerase. It may also cause some plasmin activation. The key to the action of trypsin in an inflammatory reaction relates directly to the restoration of biological continuity, to the restoration of circulation, and thereby, the prevention of further cellular damage and death."

Martin further stated,[9] "It would thus appear that the anti-inflammatory action of trypsin is a result of direct facilitation of drainage from the inflamed area. The abilities of trypsin to increase permeability, to cause vasodilation and reduce viscosity of edema will all have the effect of facilitating drainage."

The Parenzyme and Hesper-C treatment has been used in 350 athletes who suffered bruise-causing blows.

In prize fighters, ocular trauma, black eyes, and other bruises subsided in one to three days, instead of the usual 10 days to two weeks needed prior to our present treatment. The treatment has little effect on the discoloration at the site of injury once it is established; therefore, it is emphasized that trypsin be given early, before discoloration starts.

Under this regimen, bruises that ordinarily would have been painful for 10 days or more usually subsided almost overnight. In most cases, the recovery time after unusually severe bruises was approximately three days instead of the usual two weeks.

The results observed in the 350 cases may be summarized as follows: excellent in 66 per cent (231), good in 25 per cent (87), fair in 5 per cent (18), and failure in 4 per cent (14). In these 14 failures the blows had ruptured veins, which obviously posed a different therapeutic problem.

In conclusion, as a physiologist and a surgeon I am not concerned with who wins, but only how well my patient survives the stress of the game. It is the physician's duty to make every effort to assist nature to do her part adequately and completely. The physician should take measures to provide an adequate blood supply to the affected area and remove all "road blocks" to healing.

Hesper-C and Parenzyme can be depended on as adequate aides to nature in the management of injuries resulting from bruise blows. Attention to nutrition and

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* The trade name of National Drug Co. for purified crystalline trypsin in sesame oil is Parenzyme.

to tension states will facilitate recovery and condition the individual to cope with environmental stresses.

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Fifth Annual Symposium on Antibiotics

We are pleased to announce that the Fifth Annual Symposium on Antibiotics, sponsored by the Food and Drug Administration, Division of Antibiotics, U. S. Department of Health, Education, and Welfare, with the journals, Antibiotics & Chemotherapy and Antibiotic Medicine & Clinical Therapy, will be held on October 2, 3, and 4, 1957, at the Willard Hotel in Washington, D. C.

Submitted manuscripts must contain new, previously unpublished material. They must be typewritten, double spaced, on one side of 8½ by 11 inch paper. No more than six illustrations should accompany each manuscript. These glossy prints should be no larger than 8½ by 11 inches so that they can be clearly reproduced with a one third reduction. Bibliographies should conform to the style of the *Quarterly Cumulative Index Medicus*, published by the American Medical Association. Generic names of drugs should be used throughout the manuscript, except that the first time the drug is mentioned the trade name may be referred to in a footnote.

The original manuscript and one copy must be submitted by September 2, 1957. Five copies of an abstract of no more than 200 words must be submitted no later than August 19, 1957. Please submit manuscripts to:

Dr. Henry Welch, Director
Division of Antibiotics
Food and Drug Administration
U. S. Department of Health, Education, and Welfare
Washington 25, D. C.

HORMONE ACTS AS VALVE TO GASTRIC JUICE PRODUCTION. Secretin, the hormone produced by the intestine in the presence of digested food, acts as a chemical valve to reduce gastric juice production in the stomach, according to findings of Lester R. Dragstedt, University of Chicago. A high acid level promotes secretin output; this, in turn, inhibits gastrin and hence the gastric juices. In "ulcer-type" persons who are anxiety-driven, the vagus nerve stimulates overproduction of gastric juices, causing gastric ulcers in the stomach lining or intestine.

NEW RABIES VACCINE APPROVED. A new rabies vaccine for human use has recently been approved by the National Institutes of Health. Eli Lilly & Co. has been licensed to make the vaccine, which is produced in duck embryos and contains none of the paralytic fraction present in vaccine made from rabbit brain tissue. The new vaccine is considered to be safer than the old and is regarded as a highly significant development in the prevention of rabies.

BABY ATOM SMASHER USED FOR DEEP-SEATED CANCER. Use of a baby atom smasher for treating deep-seated cancer removed all traces of tumor growth in two thirds (48) of 74 patients, report Stanford Medical School radiologists. In 5 other patients the tumors disappeared, but cancer had already spread to other parts of the body. In 21 cases the treatment failed to help. Although "extremely gratified" with results, the scientists caution that new tumor growth could begin at any time and only after 5 to 10 years will use of the word "cure" even be considered.

RARE CASE OF "SEAL FINGER" REPORTED. A rare case of "seal finger," usually found only among Scandinavian sealing expedition members and occurring only in men who slaughter or skin seals, was reported by John S. Skinner (A. M. A. Arch. Dermat. & Syph., April). The subacute, severely painful and localized infection occurred in a St. Louis fur company employee who worked as a blubberer, scraping fat from the inside of seal skins during an expedition to the Pribilof Islands, Bering Sea. The only effective treatment, Dr. Skinner says, is with chlortetracycline and tetracycline.

COMPOUND RELIEVES MORNING SICKNESS. Dosage with a combination of meclizine and pyridoxine (Bonadoxin, Roerig) produced relief from morning sickness within 72 hours in 42

of 50 pregnant women, reports J. Earl Baker (J. Tennessee M. A. 1:14, 1957). Only 1 of the women experienced temporary drowsiness after taking the compound; 4 patients obtained relief from symptoms in three to seven days, another 3 benefited from treatment after one week, but experienced some nausea during the rest of the treatment period. Duration of treatment in the entire series was from 10 to 21 days.

ASPIRIN RECOMMENDED FOR SIMPLE RESPIRATORY ILLS. Based on a study of 301 private pediatric patients and 61 hospitalized patients, Miles E. Drake recommends that aspirin be used symptomatically "if the white blood count is under 10,000 and physical examination reveals an uncomplicated upper respiratory infection"; however, antibiotics and chemotherapeutic drugs lowered the complication rate in cases of a white blood count more than 10,000 (J. M. Soc. New Jersey 54:63, 1957). Also, recovery required only five days in the aspirin-treated patients who did not develop complications, eight days in those under antibiotics or other drugs.

THREE NEW MUSCULAR DISEASES. Three new hereditary neuromuscular diseases have been discovered by Swedish physicians, reports Gunnar Wohlfart (University of Lund, Sweden, Medical School). They are: proximal spinal muscular atrophy, caused by nerve lesions and having an effect similar to, but more benign than, muscular dystrophy; distal myopathy, which causes wasting of muscles in hands and lower legs of persons more than 40; and familial periodic paralysis, caused by increased amount of blood potassium (138 cases of the latter were found, but all among two families).

BARBITURATE QUADRUPLES STREPTOMYCIN PRODUCTION. By adding barbiturate sleep-producing drugs to the synthetic food for the streptomycin-producing microorganism, the production of this antibiotic has been quadrupled, report scientists of Chas. Pfizer & Co., Brooklyn, N. Y. The barbiturate used does not seem to produce its effect as a hypnotic, and it does not act as a precursor or as a coenzyme. The drug known as barbital and related compounds produce the effect.

NAVY, MARINE CORPS REPORT DROP IN ANTIBIOTIC REACTIONS. A 59 per cent decrease in admissions to the sick list due to antibiotic reactions is reported in the Navy and Marine Corps statistics for 1951 to 1955. Penicillin was the cause of 97 per cent of reactions, and the decrease in reaction rates parallels a decrease in issue rates of injectable penicillin.

BOOK REVIEWS

Blood Supply and Anatomy of the Upper Abdominal Organs: with a Descriptive Atlas. NICHOLAS A. MICHELS. Philadelphia, J. B. Lippincott Co., 1955. Pp. 581. 172 illustrations including 166 in color. Price $24.00.

Unique among surgical and anatomic atlases is this volume describing in unprecedented detail the vascular and anatomic anomalies and variations in the upper abdominal organs. During a study made in 1942, the author discovered that the pattern of terminal branching of the splenic artery is never the same in any two cases. His interest in these findings led him to devote his research life to the investigation of all the supramesocolonic organs and to the preparation of the first descriptive atlas written on the blood supply and anatomy of these organs.

Recorded in the first section are the most frequent and important variations in the blood supply of the liver, gallbladder, stomach, duodenum, pancreas, spleen, and great omentum, including routes of collateral circulation never before recorded in a textbook. Current anatomic and surgical opinions are fully discussed, and embryology, topographic relationships, and developmental anomalies are thoroughly covered. An exhaustive bibliography completes this section.

The descriptive atlas, occupying the final third of the book, consists of large, regionally complete drawings, made from the author's original sketches at dissection, and of smaller schematic drawings and outline figures. Accompanying them are detailed descriptions of the anomalies illustrated.

The surgeon will find this book a source of hard-won knowledge and an invaluable and authoritative guide in performing a variety of abdominal operations.

Bedlam. ANDRE SOUBIRAN, translated by Oliver Coburn. New York. G. P. Putnam's Sons, 1957. Pp. 319. Price $3.95.

The autobiographic accounts of patients' experiences in mental hospitals, whether true or fictional, have always had a great appeal to the public. The aura of mystery and fear of the mental hospital, which still clings in the minds of many, can evoke terror or pity, and now and then can produce action aimed at correcting abuses, as can be noted by the contributions of Clifford Beers and Mary Jane Ward.

This book, by a French physician who has already given us *The Doctors* and *The Healing Oath*, is a vigorous portrayal of the inner workings of a French hospital for the criminally insane. The narrator purports to be an offender (crime unstated) who successfully malingers a psychosis in order to escape trial. His account of the fears, jealousies, and machinations of his fellow inmates, the incompetence and indifference of the medical staff and ward personnel, lightened only by the frequent visits of his faithful wife, and the final replacement of the superintendent by a newcomer who shows a genuine interest in the patient's welfare, all make an appealing and interesting story. This reviewer is wholly unable to determine the accuracy of the picture.

—*Winfred Overholser, M.D.*

ADVANCED REPORTS FROM CURRENT MEDICAL MEETINGS

This section of the INTERNATIONAL RECORD OF MEDICINE features reports on papers delivered at current medical meetings in the United States and abroad.

Diagnosis of Congenital Dislocation of the Hip prior to Dislocation

New York City.—Congenital dislocation of the hip cannot be diagnosed accurately prior to dislocation, according to John Caffey (Sloane Hospital for Women and Babies Hospital, Columbia-Presbyterian Medical Center, New York City). The diagnosis of congenital dislocation of the hip before it dislocates has always been a challenge to radiologists. In 1950, Vernon Hart, a Wisconsin orthopedist, brought reports back from Europe that this could be done by measuring the tilt of the roof of the acetabulum, the acetabular angle. Since then, several studies have confirmed this. It has been claimed that there is a normal value for the acetabular angle and that any larger value will result in dislocation. Dr. Caffey's studies indicate that this is not so.

In a study of more than 1500 infants, Dr. Caffey found that the size of the acetabular angle was not correlated in any way with future dislocation of the hip. In the one patient whose hip dislocated, the angle was 34 degrees, which is fairly normal. There were many other infants who had angles greater than normal. These either decreased toward normal as the infant got older or remained large, but none dislocated. Perhaps this is because the cartilage, which is important in preventing dislocation, cannot be seen by roentgenogram.

One definite use of the acetabular angle is in the diagnosis of Mongolism. This is the most consistent skeletal sign in Mongoloid idiots, especially in males. Older Mongoloids frequently (20 per cent) show hypoplasia and smallness of the inferior ramus of the ischium. The pubic bone is not affected.

(Presented before the Philadelphia Roentgen Ray Society, Philadelphia, April 4, 1957.)

The Problem of Ornithosis and Psittacosis

San Francisco.—The occurrence of psittacosis is approaching pandemic proportions, says Karl F. Meyer (Director Emeritus, George William Hooper Foundation for Medical Research, University of California, San Francisco). Last year there were 600 cases reported. Dr. Meyer feels that the increase can be directly related to the increasing popularity of parakeets as pets. Immature parakeets are the most susceptible to psittacosis, yet these are the very ones sold, since only the immature birds can be taught. He estimates that there is a population of 17,000,000 parakeets in the country today. In addition to these potential carriers, the virus has infected turkeys, ducks, pigeons, and chickens as well as other birds. For this reason, Dr. Meyer prefers the name ornithosis rather than psittacosis.

The ubiquity of the disease among birds greatly increases the difficulty of control. In an epidemic of psittacosis in Oregon last year, all the cases occurred in workers in a turkey-processing plant. The turkeys were examined, and it was found that a large number were infected. In a Long Island duck-processing plant, 20 per cent of the ducks were infected. The disease has become an occupational hazard in the fowl-processing industry; however, by far the largest number of cases still occur with pet owners.

The disease assumes a latent form in the female parakeet. These birds will test negative to all the standard tests, yet under stress of shock such as nesting, the disease will again become virulent and infect the

nestlings, thus resuming the cycle. A flock may give no signs of any sick birds, be quarantined for a year, yet when the birds are allowed to mate again, the disease manifests itself in the nestlings. This makes control by injection and quarantine almost impossible.

The answer to the problem of psittacosis lies in the antibiotics. Birds that were fed diets fortified with oxytetracycline, chlortetracycline, or tetracycline were found to be free of the disease. The biggest aviaries in California have been completely cleared of the disease by adding 30 mg. of tetracycline to the birds' diet. Dr. Meyer proposes that no birds should be allowed to be sold unless they have eaten such a diet for 15 days. He also suggests that such birds have leg bands so that the public will know they are buying safe birds.

(Presented before the University of Chicago, Chicago, April 4, 1957.)

Childhood Epilepsy

Chicago.—A "good 50 per cent" of all cases of childhood epilepsy probably disappear by adulthood without the need for surgery, says Frederic A. Gibbs (University of Illinois School of Medicine). Helped by "good drugs" that control seizures, epilepsy "clears itself much more commonly than is generally supposed," he says, adding that physicians and parents are sometimes too quick to regard surgery as the only possible procedure. Dr. Gibbs says that if the disease is focused in the midtemporal or occipital areas, surgery should be undertaken only if tumors are associated with the infection. Surgery is much more common in anterior temporal lobe foci.

(Presented before the Second International Colloquium on Temporal Lobe Epilepsy at the National Institutes of Health, Bethesda, Md., March 23, 1957.)

Report on Vesicorectostomy

Louisville, Ky.—Vesicorectostomy, the creation of an artificial communication between the floor of the bladder and the anterior surface of the rectum, has been of great practical value in desperate cases that failed to respond to more conventional methods of treatment, according to John J. Robbins (Louisville, Ky.) who reviews 6 such cases. Dr. Robbins calls the surgical technique "simple," the postoperative course "short and not marred by complications."

"We feel that vesicorectostomy does not compete with other accepted surgical procedures, such as ureterosigmoidostomy and formation of ileal bladders," Dr. Robbins explains, "but instances where disease is limited to the area distal to the vesical neck offer a method of diversion of the urine which is both simple to establish and has thus far been without major complication."

Dr. Robbins tells of the first case in which vesicorectostomy was performed in December 1954, on a 65 year old man with a total prostatectomy for carcinoma, who had also sustained laceration of the rectum, with subsequent rectourethral fistula and severe stricture of the membranous urethra distal to the fistula. Two years after vesicorectostomy, an excretory pyelogram was made and reported as normal; the patient had gained strength and was generally improved.

The second case was a 22 year old man who had sustained a fractured pelvis and lacerated urethra in 1943. He had undergone eight separate operative procedures, all of them unsuccessful. Vesicorectostomy provided satisfactory emptying of the bladder, and the patient remained asymptomatic during the year the case was followed.

Two of the 4 other cases reviewed were of severe urethral strictures. A third patient had ureteroperineal fistulas because of urinary extravasation and had been subjected to three attempts at resection of the urethra with recurrence each time. The last patient was a 57 year old man whose penis was totally destroyed by squamous cell carcinoma. All four of these patients received major benefit from the procedure.

(Presented before the Great Lakes Division, International College of Surgeons, French Lick, Ind., April 7–10, 1957.)

QUARTERLY REVIEW OF OPHTHALMOLOGY

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FOREWORD: A New Policy

The objective of the QUARTERLY REVIEW OF OPHTHALMOLOGY is to bring together in one publication a concise record of current happenings, both national and international, in this field. Selection and editing of material are designed to prove informative to *the entire medical profession* as well as to ophthalmologists. Manuscripts for the QUARTERLY REVIEW OF OPHTHALMOLOGY should be submitted to Dr. Arnold S. Breakey, Ophthalmological Foundation, 111 East 59th St., New York, N. Y.

The Study of the Rebound Pulse as a Method of Diagnosing Papilledema

Prof. W. J. Kapuściński
WARSAW, POLAND

This paper considers the diagnostic differential of papilledema and inflammatory papillitis, based on the little known facts concerning the behavior of the rebound pulse of retinal arteries. This subject should be of interest not only to ophthalmologists, but also to neurologists, neurosurgeons, and internists. The rebound pulse, a phenomenon not widely discussed, is mentioned only in Adler's *Physiology of the Eye*, which is based on Friedenwald's work.

This phenomenon and its relationship to the normal pulse as well as to the tension of the artery of the retina were the subject of a detailed description by W. Kapuściński, Sr., published in the *British Journal of Ophthalmology* in 1949. I have continued these studies, using Gullstrand's binocular ophthalmoscope. The phenomenon in question consists of a rapid movement of the central artery and its ramifications, visible chiefly in those places where the artery forms an S-shaped curve. The artery moves simultaneously with each systole palpated on the radial pulse, while diastole brings it back to its original position. This phenomenon is shown in the rectilinear arteries by reflex movements. These movements have nothing in common with the pulsation provoked by outside pressure, in which the vessel's light contracts and expands. Nor should they be confused with the spontaneous venous pulse, which is never simultaneous with the rebound pulse of the artery. It is a physiologic phenomenon, caused by the afflux of blood above all on the incurved arterial walls during systole. The physiologic and hydrodynamic laws of this phenomenon are elaborated elsewhere. It is observed in all healthy subjects, even the aged. The rise in difference between the general systolic and diastolic tension aids in the distinction of the phenomenon in question. It can also be observed on the forearm artery in the aged, in thin subjects, and, experimentally, on the epiploon and femoral artery of the dog. During four years of study, we have observed that this phenomenon is always very distinct in pseudoedema, for example in hypermetropic children. It is also distinct in most cases of inflammatory papillitis and in papillary edema, caused by an azotemic retinopathy. In brief, it can be observed, more or less clearly, in all cases where the papillary edema is due to an inflation of nerve fibers to the level of the papilla. However, when papillary edema is due to a venous and lymphatic stasis in the retrobulbar part of the optic nerve, a pressure compressing the central artery of the retina in its path through the nerve hinders or suppresses the diastolic

pulse movements. This takes place first in the beginning of papilledema cases, provoked by increased intracranial tension. Second, the pulse phenomenon also weakens in stasis resulting from a retrobulbar tumor oppressing the nerve. The phenomenon is then unilateral. It is also unilateral in some cases of acute retrobulbar neuritis, but in these cases there is not always a weakening of the rebound pulse.

In 1956, I published a study of 88 cases of various fundus oculi diseases, chiefly of the optic nerve, in the *Annales d'oculistique*. Among the cases observed were 18 papillary stases of intracranial origin. There were initial papilledema images as well as developed papilledema. The diastolic pulse was very weak or absent, especially on papillary arteries and border. We also noted a reappearance of the diastolic pulse after a successful neurosurgical operation on an intracranial tumor. After a two year study of neuritis, pseudoneuritis, and papilledema, we can only confirm the fact of the pulse's disappearance in true papilledema. This phenomenon was also verified in Paul Bregéat's great monograph *Papilledema* (Masson, 1956). This is evidently not the only factor in the diagnostic differential between neuritis and papilledema. I will not mention here facts that are already common knowledge. I will only remind you of the Sobański sign. According to this author, if the ratio between the diastolic tension of the retina and the tension of the vein goes below 1:2, it is a sign of the intracranial origin of papilledema.

We do not yet have a clear explanation of the disappearance of the diastolic pulse in intracranial papilledema. An experiment performed on a dog shows that an injection of 20 cc. of the normal solution into the epiploon visibly weakens the diastolic pulse below the injection. The diastolic pulse studied on the forearm of an old man, whose maximum tension was 160, had disappeared after a Riva-Rocci sphygmomanometer pressure of 130. It is therefore not necessary to attain the maximum tension to make the diastolic pulse disappear.

It must be noted that the rebound pulse can be seen very faintly on a narrow vessel. This is the case in some atrophies of the optical nerve, in pigmentary degenerations, in accentuated hypertension. Following are 4 examples of this phenomenon: (1) an 8 year old boy, hypermetropia 9 D., papillary pseudoedema, very marked diastolic pulse; (2) a 60 year old woman, field of vision without change, hypertension stage II, papillary edema 3 to 4 D., weak rebound pulse; after medical treatment, the edema was diminished, there was a weakening of tension, and a very marked rebound pulse; (3) a 52 year old woman, essential hypertension stage I, past syphilis, papillary edema 3 D., very marked rebound pulse, no signs of intracranial hypertension; (4) a 55 year old woman, papilledema 8 D., field of vision: paracentral scotoma, rebound pulse absent; all the signs of intracranial hypertension; patient referred to the neurosurgeon.

Letter from Paris

I have been asked to write a letter for the QUARTERLY REVIEW OF OPHTHALMOLOGY giving an idea of the most recent trends in French ophthalmology. This is a difficult assignment since there is very little difference today between medicine and ophthalmology in the various countries: congresses, medical publications, and society meetings create so many contacts that uniformity is almost the rule.

NEW TREATMENT FOR AMBLYOPIA

Possibly an exception is the treatment of amblyopia (poor vision due to lack of use), which has recently been greatly influenced by the work of Cuppers (of Giessen, Germany). This new type of treatment is based on the fact, rather recently discovered, that many amblyopic eyes have a fixation off-center and that if one can re-establish a central fixation the vision improves dramatically.

Instead of patching the good eye for months, it is now often possible, in a matter of four to eight weeks, to cure or to improve considerably quite a few cases of amblyopia, whether or not associated with strabismus. This treatment requires two new instruments. One, very similar to an ordinary ophthalmoscope, projects a small, sharply defined cross on the retina. When the child looks directly into the light, one observes at what point the cross is projected and what its relationship is to the macula. The treatment is undertaken only when this projection shows an excentric fixation. This requires the next instrument, called the euthyscope which throws a strong light on the retina. The very center of the field is protected by a small screen, and this center is aimed exactly on the center of the macula. The result is that for quite some time the patient has a strong afterimage in the form of a dark circle with a clear center corresponding to the central macular area. This makes the child conscious of the real visual line corresponding to his fovea, and as he uses it, his visual acuity improves.

One of the most unexpected aspects of this type of treatment is that better results can be expected when the fixation is fairly far from the fovea than when it is close to it.

OUTFLOW TESTING EMPHASIZED IN GLAUCOMA

The symposium held in Ste. Marguerite in September 1954 has had a marked influence on the understanding of glaucoma: the angle of the anterior chamber is more often examined, and the study of the resistance to the outflow of aqueous is considered important in borderline cases. Medications that calm the nervous system are almost routinely used, and in that respect, the new ataractic drugs are being tried, as well as *Rauwolfia*.

This article is the second in a series featuring reports from ophthalmologists throughout the world.

MEDICAL TREATMENT OF CATARACTS

There is nothing new in the surgical removal of cataract, but attempts are still being made to check the disease in its early stages: vitamin C is given orally and drops containing sodium iodide and triphosadenine are used topically. In many cases when they seem indicated, hormonal preparations are prescribed, in particular testosterone. It is of course very difficult to evaluate this treatment, since the normal course of a cataract is most capricious.

The Ridley operation, whereby an acrylic lens is inserted to replace the removed cataract, has been almost abandoned because of late complications, in particular dislocation into the vitreous.

NEW STANDARD FOR AUTO HEADLIGHTS

There have been some interesting studies lately on the best color for automobile headlights. Although white light is used in most countries, yellow light is compulsory in France and in a few other countries. Recent research has shown definite advantages in yellow light since the recovery from blinding is more rapid when the eyes have been hit by yellow than by white light.

PHYSICIANS' FEES LIMITED BY LAW IN FRANCE

Like all other French physicians, ophthalmologists have been greatly concerned by the new law regulating the practice of medicine, which has been prepared by the Administration and will shortly be submitted to Parliament. It deals with the fees to be applied to patients belonging to the Social Security group, which means roughly 85 per cent of all patients.

Until now the Social Security Administration, which is a Government department, reimbursed the patients a fixed amount for each consultation, regardless of the physician's fee. The patient was free to go to any doctor he chose, but of course, the percentage of the fee returned to him by the Administration varied a lot depending on the standing and the fee of the physician chosen.

According to the new law, the patient will be reimbursed 80 per cent of his expenses in all cases, but for this to be feasible, the fees are to be all the same, fixed by the Government, and at a very low level. In Paris 600 francs, which is $1.50, will be charged for an office consultation and 700 francs for a home call ($1.75). Specialists, ophthalmologists for instance, will be allowed a double fee, and a small group of physicians, 15 per cent of the total number of the physicians practicing in France, will be allowed higher fees. When a plumber comes to a home to replace a washer, he charges approximately $2.50, and the Union fee for a radio or television repairman is approximately $5.

Edward Hartmann, M.D.
Paris, France

ABSTRACTS

MEDICAL OPHTHALMOLOGY

14. *Disturbances of Ocular Motility in Relation to Supranuclear Lesions.* ROBERT L. TOUR, San Francisco, Calif. Am. J. Ophth. *42*:873–883, December, 1956.

The ophthalmologist is frequently the first to be consulted for some disorder of ocular motility resulting from a supranuclear lesion. Although treatment may not be his primary responsibility, he should be capable of giving considerable assistance in regard to precise localization and diagnosis.

Supranuclear lesions generally result in interference with over-all movements of the two eyes and can be categorized according to their location, as follows: affections of the frontal mechanism that disturb voluntary control; involvement of the disjunctive mechanism involving convergence and divergence; disorders of the occipital mechanism disturbing the fixation and fusion reflexes; and lesions of the extrapyramidal mechanism producing alteration of co-ordination, orientation, and muscle tonus.

Conjugate or gaze palsies are produced by lesions involving the frontal lobes; subcortical lesions may produce this same picture but are somewhat more permanent. Pareses of conjugate vertical gaze have been found to be much rarer than those of lateral gaze. Disjunctive deviations are relatively rare and, as in the case of Parinaud's syndrome, are usually associated with other motor anomalies.

Occipital lesions produce disturbances of fixation and fusion, although there are usually associated visual field defects. Lesions involving the extrapyramidal mechanism commonly result in hesitancy of voluntary movement, in tremor, or in some alteration of muscular tonus. Disturbances of conjugate torsion are almost pathognomonic of vestibular involvement. Dissociated deviations are primarily caused by lesions involving the medial longitudinal fasciculus and in which there results unequal involvement of the two eyes. This is characterized most commonly by the syndrome of internuclear ophthalmoplegia. 6 references.—*Author's abstract.*

15. *Retinal Lesions Associated with Uveal Disease: Part 1.* BERTHA A. KLIEN. Am. J. Ophth. *42*:831–846, December, 1956.

Retinal involvements associated with uveal disease fall into several categories, namely, inflammatory, functional, and degenerative.

The inflammatory manifestations can be grouped under two subdivisions: (1) those encountered predominantly in the retinal stroma or on the retinal surface, as in retinitis serosa, and (2) those affecting mainly the retinal vessels in the form of arteriolitis, phlebitis or periphlebitis, and capillaritis.

The diagnostic importance of retinitis serosa, which is a relatively rare affliction, lies in its aftereffects on vitreous and retina. Therefore, an attempt was made to circumscribe more definitely its clinical picture. It occurs together with a post-

operative or post-traumatic nonspecific infiltrating iritis or with an endogenous iridocyclitis of similar type and long duration. There is some evidence that in all those instances it may be part of a low grade lens-induced inflammation, in which steroid therapy may be useful and may prevent some of the late complications.

Among the organic vascular lesions of the retina associated with uveitis, arteriolitis seems to be diagnostically the most helpful, having so far been found only in frankly tuberculous disease. Phlebitis and periphlebitis may accompany a variety of uveal lesions. They are an essential part of the triad of findings in neuroretinitis papulosa of syphilitic origin, and they are not uncommon in tuberculous uveitis and in lens-induced inflammation. Retinal capillaritis is part of the picture of lens-induced inflammation when it extends to the posterior segment. It may also appear in retinitis serosa.

The functional disturbances of the retinal vessels associated with uveitis confuse rather than aid the diagnosis. The picture of central angiospastic retinopathy with serous or hemorrhagic extravasations may overshadow the symptoms of the uveal disease, especially in the initial stages, with the inherent danger of an erroneous diagnosis. Thus, the functional vascular disturbances, allergic or toxic in origin, are the most important retinal participation in uveal disease to remember when interpreting the subjective and objective clinical picture.

16. *Pathological Survey of Malignant Melanomas of the Uveal Tract.* CHRISTOPHER DEEN, Detroit, Mich.

During the years 1950 to 1953, 66 eyes harboring malignant melanomas were received at the Kresge Eye Institute, Detroit, Michigan, for pathologic diagnosis. An analytic study of these was made, with the following findings.

The tumor was slightly more common in men. The greatest incidence was found in the fifth and sixth decades. In the uveal tract, the choroid was the commonest site of origin, 83 per cent of the tumors originating there. In the choroid, 50 per cent of the growths were in the posterior segment, while only 36 per cent were in the anterior. All these findings agree with those of the other investigators.

Of the 55 eyes that had tumors arising in the choroid, only 8 were localized, 14 showed external extension, and 33 extended to involve other intraocular structures. The ciliary body had 9 per cent of the malignant melanomas and the iris had 7.5 per cent. Mixed cell type of tumor was the commonest in occurrence (62 per cent of the series). This incidence was found to be higher than that of any of the other observers. Spindle cell subtype B was the next commonest. Of the 41 cases of mixed cell type, 35 were a combination of spindle cell B and epithelioid cell types. Though there were only 4 tumors of spindle cell subtype A, 3 of these were found to be densely pigmented. The epithelioid and fascicular cell types showed less pigmentation. No particular relationship was noted between tumor cell type and reticulum content.

A varying amount of necrosis was seen in 32 of the 66 tumors. It was noted more in spindle cell A and mixed cell types. Inflammatory changes around the tumors were noted in 26 eyes. Retinal detachment was seen in 53 of 55 cases of tumor in the choroid. The 2 cases that did not show it had diffuse flat growths. Glaucoma

was associated in 15 cases. Of these, 11 eyes had anterior synechiae. External extensions were seen in 17 eyes.

The diagnosis of malignant melanoma was not suspected in 12 cases, that is, 18 per cent had a mistaken diagnosis. Of these, 9 were diagnosed as glaucoma. 4 references. 19 figures. 14 tables.—*Author's abstract.*

17. *Preretinal and Optic Nerve-Sheath Hemorrhage: Pathologic and Experimental Aspects in Subarachnoid Hemorrhage.* DALE C. SMITH, THOMAS P. KEARNS, AND GEORGE P. SAYRE, Rochester, Minn. Read at the meeting of the American Academy of Ophthalmology and Otolaryngology, Chicago, October 14–19, 1956.

Preretinal hemorrhage generally is recognized to be a rather characteristic finding in patients suffering from subarachnoid bleeding. Hemorrhage of the optic nerve sheath probably is as common but is not so well recognized, since it is not visualized ophthalmoscopically. Ballantyne in 1943 first stressed the fact that hemorrhage of the optic nerve sheath, as well as intraocular hemorrhage, is an independent phenomenon that has no direct continuity with the intracranial bleeding that is also present. Walsh and Hedges have recently concurred in this opinion. A study of the pathologic factors that led the authors, also, to agree with this opinion is presented. An experimental technique is described in which dogs and monkeys are used. Neither retinal hemorrhage nor hemorrhage of the optic nerve sheath occurred in the dog, but these types of hemorrhage were produced in the monkey. This experimental production of preretinal hemorrhage and hemorrhage of the optic nerve sheath seems to confirm the concept that the processes are independent hemorrhagic phenomena.

18. *Clinical Diseases of Adults Associated with Sporadic Infections by APC Viruses.* E. JAWETZ, L. HANNA, AND S. J. KIMURA. A. M. A. Arch. Int. Med. *98*:71–79, July, 1956.

Adenoidal-pharyngeal-conjunctival (APC) viruses are widely accepted as important etiologic agents in respiratory disease in military men and in children. It is becoming clear that a wide range of diseases, from minimal to severe and involving one organ system or many, can occur. The majority of proved sporadic APC virus infections in adults observed by the authors have involved the eye. The constancy of eye affection has suggested that the eye may serve as portal of entry, and this concept is supported by the difficulty of infecting volunteers with APC virus through the respiratory tract and the ease with which infection follows application of the virus to the conjunctiva. Cases have been observed in which conjunctivitis was the first symptom of disease and preceded systemic manifestations by several days.

SURGICAL OPHTHALMOLOGY

19. *Treatment of Senile Macular Degeneration: By Advancing the Inferior Oblique Muscle.* RONALD M. BURNSIDE, Dallas, Texas. Am. J. Ophth. *42*:911–914, December, 1956.

The advancement of the inferior oblique muscle over the macula in the region of

the short ciliary arteries may establish a long-lasting collateral blood supply when a physiologic need is present. The patient with advanced arteriosclerosis should, if possible, have a posterior sclerotomy beneath the transplant for collateral circulation to the choroidal vessels plus anastomosis to the short ciliary arteries. The use of mild chromic sutures seems in itself to augment the number of vessels established in the site.

No untoward cosmetic defects, such as squint or ptosis, were noted in any of the eyes after surgery. The animal used in an effort to produce actual advanced macular degeneration by direct sunlight surprisingly did not show the expected reaction immediately after the operation or after the two month interval. Possibly the marked hyperemia produced by the operative procedure rapidly dissipated the heat and prevented extension of the damage to the retina. The anastomosis was most marked after infrared burns of the macular area, as would be expected on the basis of physiologic need.

In conclusion, advancement of inferior oblique muscle with or without posterior sclerotomy may be a means of establishing collateral circulation to the choroid beneath the macula in presenile and senile degeneration. This is a relatively simple procedure without serious complications to the eye. Possibly, it should be done first on the poorer eye in individuals with less than 20/50 vision.—*Author's abstract.*

THERAPEUTIC OPHTHALMOLOGY

20. *Novobiocin, a New Antibiotic: Ocular Penetration and Tolerance.* THEODORE W. SERY, SATYA DEV PAUL, AND IRVING H. LEOPOLD, Philadelphia, Pa. A. M. A. Arch. Ophth. *57*:100–109, January, 1957.

Novobiocin was administered to rabbits by several routes. Aqueous and vitreous humor withdrawn from different animals at regular intervals was subjected to bioassay procedure by making serial dilutions in nutrient broth and noting the growth-inhibiting properties of the mixtures against a strain of *Staphylococcus aureus*. The presence of 20 to 30 μg./ml. of the drug represented a relatively significant level for inhibition of sensitive bacteria. Local application of a solution concentration of 10,000 μg./ml. did not lead to detectable amounts in the aqueous humor of normal eyes. In eyes with mechanically abraded epithelium, however, 20 to 30 μg./ml. was detected in the aqueous humor. Concentrations of 25,000 μg./ml. were toxic to the ocular tissues. Subconjunctival injections of 12,500 μg. led to significant amounts in the aqueous humor. Lower dosages were apparently inadequate and higher ones were toxic. Intravenous injections of 500,000 μg. led to aqueous levels of 20 to 30 μg./ml. when serum levels measured around 240 μg./ml. Higher aqueous levels were found in animals that had received acid burns of the cornea. In these same animals the secondary aqueous taken 30 minutes later was found to contain a three- to ninefold increase in novobiocin over that found in the primary aqueous. Generally the best aqueous level was reached during the second and third hours and the drug was almost gone by the sixth hour. Intra-aqueous and vitreous injections of 200 μg. or less were well tolerated and the drug was detectable in the vitreous after 24 hours. 24 references. 6 tables.—*Author's abstract.*

21. *Use of Iodo-Niacin: for Retinal or Vitreous Hemorrhages and Vitreous Floaters.* IRA A. ABRAHAMSON, JR., AND IRA A. ABRAHAMSON, SR., Cincinnati, Ohio. Am. J. Ophth. *42*:771, November, 1956.

In a controlled clinical investigation, Iodo-Niacin tablets provided successful results in a series of 22 cases of retinal and vitreous hemorrhages and 89 of vitreous floaters. Compared with a group on placebo medication, the treated patients showed much more rapid and complete absorption of retinal and vitreous hemorrhages. Iodo-Niacin tablets contain potassium iodide, 135 mg., and niacinamide hydroiodide, 25 mg. No case of severe iodism occurred with the use of niacinamide. Absorption of retinal hemorrhages in patients treated with Iodo-Niacin was observed ophthalmoscopically and recorded by before and after retinal photographs. More than 90 per cent of the 89 treated patients with vitreous floaters showed subjective improvement, and of these, 50 per cent showed objective improvement. Not one of the 34 controls was improved.

PREVENTIVE OPHTHALMOLOGY

22. *Blindness Control in Canada.* J. H. GROVE. Canad. J. Pub. Health *47*:413–419, October, 1956.

Blindness is described as an acuity of 20/200 or less, not correctable, or a field constricted to less than 20 degrees. There are approximately 30,000 blind persons in Canada, 0.2 per cent of the population. There is a high incidence of blindness in middle and old age. Glaucoma, cataract, diseases of the uveal tract, optic atrophy, and diabetes are notable causes. Glaucoma causes 11 per cent of blindness. In infancy, congenital lesions and retrolental fibroplasia are prominent; in youth, injuries and infections become important causes.

Cataracts cause about 20 per cent of blindness, which can be cured in 90 per cent of cases by operation. Corneal transplantation and operations for retinal detachment also can restore sight.

The Blindness Control Division of the Federal Government reviews claims and issues certificates of blindness. It assists blind patients to have operations and supports eight glaucoma clinics located across Canada. 15 references.—*Clement McCulloch, M.D.*

23. *The Complete Elimination of Retrolental Fibroplasia.* PHILIP BANISTER AND JOHN C. LOCKE. Canad. M. A. J. *76*:81–85, January 15, 1957.

This study of 114 premature infants indicates that it is possible to eliminate retrolental fibroplasia completely. The occurrence of retrolental fibroplasia is due to failures in technique: (a) failure to use an oxygen analyzer regularly, (b) failure to recognize that concentrations of oxygen higher than 35 to 40 per cent are only exceptionally required, (c) failure to realize that concentrations of oxygen below 40 per cent are not always safe, (d) failure to realize that excess oxygen is the only cause of retrolental fibroplasia, (e) failure to realize that prevention of retrolental fibroplasia can be compatible with survival of sick or very small infants requiring

oxygen. A list of recommendations for the control of oxygen therapy in premature infants is appended to the article. 8 references. 4 figures. 1 table.—*Clement McCulloch, M.D.*

BOOK REVIEWS

Glaucoma. Transactions of the First Conference, December 5, 6, and 7, 1955, Princeton, N. J. Edited by DR. FRANK W. NEWELL. New York, Josiah Macy, Jr. Foundation. Price $4.50.

This interesting book contains: "A Review of Angle-Closure Glaucoma," "Central Control of Intraocular Pressure," and "Physiologic and Pharmacologic Factors Influencing the Resistance to Aqueous Outflow." These subjects are treated in the manner of a round-table discussion by such distinguished ophthalmologists as Drs. Peter C. Kronfeld, Frank W. Newell, Elmer James Ballintine, Bernard Becker, Paul Austin Chandler, W. Morton Grant, Robert N. Shaffer, H. Saul Sugar, Ludwig von Sallmann, and Ernst Bárány. Other participants were Drs. Melvin L. Goldman, Herbert S. Ripley, Winston Roberts, Robert W. Berliner, and Emily W. Emmart.

In the discussion of "A Review of Angle-Closure Glaucoma," the participants agreed that the increase tension of angle-closure, or narrow-angle, glaucoma is on the basis of the iris root blocking the flow of aqueous through the trabecula, and that a relative pupillary block is the primary basic mechanism involved. Pupillary dilation of secondary importance may have a varied role. The peripheral iris may give sufficiently to be pushed against the trabecula; sufficient iris may be bunched into the angle to block the outflow itself or the iris may break a pupillary block mechanism.

It was thought that some central nervous system influence may act as the trigger mechanism of a glaucomatous attack, and it seems improbable that changes in the rate of aqueous formation are of significant importance. Changes in the vascular bed of the choroid and ciliary body could be of sufficient volume to institute an attack in an eye with a narrow angle, and these volume changes could be produced either acutely or chronically by psychologic influences.

The attack caused by an angle blocked by iris may be aborted by the miosis caused by exposure to light or by the sleep mechanism. Increased pressure may possibly inhibit aqueous production, or the attendant pupillary dilation may break the pupillary block mechanism. Permanent synechiae may not occur in chronic narrow-angle eyes, since their production is dependent on edema of the iris. Such eyes may have a decreased facility of aqueous outflow if the iris was in opposition to the trabeculum for any length of time.

A progress report of the experimental work with animals on the central control of intraocular pressure, conducted at Columbia University and the Ophthalmological Branch of the National Institute of Neurological Diseases and Blindness in Maryland, was given by Dr. Ludwig von Sallmann.

The presentation on "Physiologic and Pharmacologic Factors Influencing the Resistance to Aqueous Outflow" was conducted by Dr. Ernst Bárány. The experimental work that was done in the perfused enucleated animal eyes had two aspects:

the first was concerned with chemical dissection of the trabecular meshwork and the second with the regulation of the resistance of the trabecular meshwork. The apparatus and technique employed are described, and the findings are well documented by graphs and tables.

The book is clearly printed and well illustrated and gives an excellent review of recent advances in knowledge covering acute glaucoma. Excellent references follow each presentation and the index seems complete. Brief autobiographic sketches of the participants conclude this interesting 250 page volume, which leaves one with the feeling of actually having sat in on the Transactions and personally asked questions of these great authorities.—*Conrad Berens, M.D.*

I Cursillo Internacional de Oftalmologia Especial (Resumen) 1956. Barcelona, Publicacones Del Instituto Barraquer. 80 pages. 8 colored illustrations.

A résumé of the First International Course in Special Ophthalmology held at the Barraquer Institute in Barcelona, Spain, in 1956 has been published in a clearly printed, concise work. Twenty-two leaders in ophthalmology from many countries have written short monographs on their fields of special interest. For example, G. Bietti discusses ocular virology; J. Charamis, ocular cysticercosis; H. Goldmann, biomicroscopy of the vitreous; W. Leydhecker, electrotonography; G. Meyer-Schwickerath, photocoagulation of the iris and fundus; C. D. Shapland, scleral resection for retinal detachment; J. Barraquer, keratoplasty; and Professor I. Barraquer, the evolution of phacoerysis. All the other monographs are important up-to-date contributions, and these and the others just mentioned should be read by all physicians and ophthalmologists who desire the latest information on the newer ideas and techniques in ophthalmology.—*Conrad Berens, M.D.*

An Atlas of Diseases of the Eye. E. S. PERKINS AND PETER HANSELL. Boston, Little, Brown & Company. 43 pages. 168 colored illustrations. Price $10.00.

This *Atlas* is intended primarily for medical students, interns, residents, and the general medical practitioner. The authors' purpose is to offer the physician who is not an ophthalmologist the next best substitute for studying the patient himself, which is the colored photograph, drawings in some cases, accompanied by a brief description of the disease entity. The presentation by this method is perfectly done.

The organization of the *Atlas* as a whole, one page for each eye disease, makes the material easily located and quickly grasped. The colored illustrations are of the highest quality. In fact, the price of the *Atlas* is only one third of the cost of production, since the book has been subsidized. There is no other atlas of the more common ophthalmologic conditions with colored illustrations.—*Gerald Fonda, M.D.*

The Visual Fields, A Textbook and Atlas of Clinical Perimetry. DAVID O. HARRINGTON. St. Louis, C. V. Mosby Co., 1956. 327 pages. 234 illustrations and 9 color plates. Price $16.00.

This text and atlas of visual fields is without a peer in this subject and very likely

will be for many years to come. The book is intended for students of ophthalmology and neurology and practicing ophthalmologists and neurologists. The author's purpose in writing this book was to crystallize his experience in teaching perimetry over a period of 20 years. This has been done exceptionally well because the book represents the enthusiasm and personal experience of an ophthalmologist and neuro-ophthalmologist who personally has used and exhausted all the methods of examination described, as well as plotted the fields of all the visual field variations. Seldom has an ophthalmologist enjoyed the most favorable opportunities of studying under Traquair, having the inspiring cooperation of the celebrated neurosurgeon Naffziger, having the use of material of a large active hospital and of a private practice of ophthalmology as well as the experience and records of military ophthalmology.

Technically the text is logically organized and clearly and concisely written. The atlas method of presentation enhances the value of this excellent book. This is especially true for the neurologic aspect because the site of lesion and the field of defect are demonstrated in the same diagram, as is the sequence of the development of visual defects.

This book excels all other texts on visual fields for all those interested in this subject. Some of the material is original, as are most of the illustrations. The tremendous experience, personal ability, and enthusiasm of the author are reflected from every page. The bibliography contains extensive material from textbooks, monographs, and review articles. —*Gerald Fonda, M.D.*

Eye Surgeon Honored

Dr. John McGavic, Bryn Mawr, Pa., noted eye surgeon, recently received the Merit Award of the Iowa Wesleyan College Alumni Association presented in recognition of distinguished achievement in a chosen occupation. Dr. McGavic has been director of the laboratory of Wills Eye Hospital, Philadelphia, and Associate Professor of Ophthalmology at Good School of Medicine, University of Pennsylvania. He is now Professor of Ophthalmology at Temple University and civilian consultant to Valley Forge Army Hospital.

Modern Techniques for Ophthalmic Research

From the invention of the ophthalmoscope in 1851 to the present day, progress in ophthalmology has been associated with the development of new investigative techniques. Within the past 20 years, the development of radioactive isotope techniques, the modifications of electrophoretic methods, and the improvements in electronic instruments have played an important role in ophthalmic research.

RADIOACTIVE ISOTOPES HELPFUL IN RESEARCH AND DIAGNOSIS. Radioactive isotopes are chemical substances that spontaneously emit radiations. Although a radioisotope can be detected by means of these radiations, it is not differentiated from its nonactive normal counterpart in the metabolic processes of the body and can thus be used as a tracer for studying these processes. Isotopes have been applied to studies of transfer rates across the blood-aqueous barrier and of turnover rates of corneal mucopolysaccharide or lenticular amino acids. Proteins have been tagged with isotope and have been used for basic immunologic studies. Clinically, the preferential accumulation of radioactive phosphorus-32 in melanomas has been utilized for diagnostic purposes.

LENS PROTEINS STUDIED BY ELECTROPHORESIS. Electrophoresis is a technique for the separation and isolation of the components of a group of similar chemical substances. As significant functional differences are often associated with slight alterations in chemical sturcture, the fractionation of such substances is both important and difficult. Electrophoresis, based on the differential movement of ions or charged particles in an electric field, is a most sensitive method for such separation. It has been applied to a study of the proteins of aqueous, lens, and vitreous. This type of basic research is fundamental for the eventual understanding of the pathogenesis of such disease states as cataract or fluid vitreous.

THE INFANCY OF ELECTROPHYSIOLOGY OF THE EYE. The recent improvements in electronic design have facilitated the detailed study of the electrical manifestations of ocular structures. As these electrical manifestations are in general difficult to detect, the instruments utilized must

satisfy rigorous standards of performance in order to obtain significant results. Electromyography applied to the ocular muscles is greatly increasing our understanding of basic neuromuscular physiology as well as serving as a practical diagnostic tool for many neuromuscular disorders. Electroretinography has afforded us a unique method for determining total retinal function and for comparing rod and cone function. Electrophysiology of the eye is still in its infancy, like the electrocardiogram of Einthoven's day. However, it is anticipated that electrophysiology will take the same firm seat in ophthalmology that the cardiogram has assumed in medicine.

Although these techniques have led to considerable progress in ophthalmology, they have at the same time helped to uncover further complexities of the basic problems. While many biologic problems are still beyond the reach of our most sensitive techniques, the rapid advances of our scientific age offer promise for the future.

Ralph Z. Levene, M.D.
New York, N. Y.

XVIIIth International Ophthalmological Congress

The XVIIIth International Ophthalmological Congress will be held in Brussels, Sept. 8 to 12, 1958. Professor Léon Coppez of Brussels has been named president of the Congress. The main subjects chosen for discussion are: orthoptic treatment of concomitant strabismus—presented by A. Bangerter, St. Gallen; T. K. Lyle, London; and J. Malbran, Buenos Aires—and geriatrics in ophthalmology—presented by M. Buerger, Leipzig; J. Francois, Ghent; G. Jayle, Marseille; and M. Jayle, Paris. Symposia will be held on cataract, radioisotopes in ophthalmology, electroretinography, and glaucoma. The International Association for the Prevention of Blindness and the International Organization Against Trachoma will hold meetings during the Congress. All correspondence regarding the meeting should be addressed to the General Secretary, Professor Jules Francois, 15, Place de Smet de Naeyer, Ghent, Belgium.

Questions and Answers

Q. *A local ophthalmologist found my patient to have aniseikonia and prescribed expensive glasses to correct it. Another ophthalmologist stated that the value of the glasses was mainly psychologic. Is this true?*

A. It is impossible to answer this question without knowing more about the history and findings of your patient. In general terms, the percentage of patients benefited by aniseikonic (size) lenses varies with different examiners. Many distressing ocular symptoms have been relieved by properly fitted size lenses in patients who were unable to obtain relief from any other measures. On the other hand, the psychologic effect on certain patients of a long and expensive examination cannot be denied.

Q. *What precautions should be taken during an attack of measles in children complaining of severe discomfort of the eyes?*

A. The conjunctiva is involved together with the mucous membranes of the URI in the initial stages. Involvement is usually limited to catarrhal conjunctivitis with photophobia and lacrimation. Rubbing of the eyes may result in Keratitis with all its disastrous sequelae (ulceration, perforation, panophthalmitis). The time-honored remedy of keeping the child in a darkened room and limiting the use of the eyes is still advisable. Cold compresses may be applied for 10 to 15 minutes three times a day. Mild disinfecting solution may be employed if signs of purulent conjunctivitis appear. Antibiotic drops or ointments (without steroids) are beneficial. If the complaints persist, an ophthalmologist should be consulted.

Q. *A turn of one eye was noticed in a child three weeks after an attack of measles. Is there any direct connection between the turn and the preceding illness?*

A. Strabismus due to paralysis of the extraocular muscles during or after measles is known but rare. The intraocular muscles are more frequently affected, resulting in insufficiency of accommodation. If, in such a case, a tendency to squint was present preceding the measles, the squint may become manifest during or after the disease. It may disappear after recovery or become permanent.

Q. *Is color blindness always congenital?*

A. It is usually congenital but may also be acquired. In these cases it follows injury to the retina, optic nerve, or central visual pathways, and is sometimes associated with central scotoma. Acquired color blindness is frequently found in one eye only, although a case of unilateral, supposedly congenital, color blindness has been reported in the literature.

Note: The editors invite your questions, which will be referred to leading ophthalmologists around the country for answering and reprinted in this section. Direct correspondence to George Z. Carter, M.D., Ophthalmological Foundation, 111 East 59th St., New York, N. Y.

Q. *A patient who suffers from recurrent cystitis complains of deterioration of vision after every attack. During the intervals between attacks his vision returns to normal. Can cystitis cause changes in vision?*

A. It would be helpful to know what organisms are causing the cystitis as well as the existence of any primary focus of infection. It is known that toxic states may affect the accommodation of the eye and thereby cause changes in refraction. On the other hand, medication may be responsible. Sulfonamides are known to cause such changes, although the mechanism of their action is not exactly known. It could be due to swelling of the lens, spasm of accommodation, or increase in refractive index of ocular media.

Q. *What is the percentage of successful cataract operations today?*

A. Statistics on this subject vary depending, among other things, on the surgeon and on the patient's condition (general and ocular). Many systemic factors that might adversely influence the outcome of the surgical procedure can be found during a thorough preoperative physical examination and be eliminated or corrected. The ophthalmologist can determine the functional integrity of the eye even though the cataractous lens prevents direct examination of the posterior segment. Thanks to modern ophthalmic instruments and knowledge, many complications may be foreseen and prevented. With adequate preoperative preparation and modern surgical techniques, good useful vision results in from 85 to 90 per cent of the eyes upon removal of uncomplicated cataract.

Q. *In the March 1957 issue of the* QUARTERLY REVIEW OF OPHTHALMOLOGY *you mentioned the use of contact lenses after the extraction of monocular cataract. Can all these patients wear a contact lens?*

A. No. Certain rather rare ocular conditions, which can usually be found preoperatively, contraindicate wearing of a contact lens. On the other hand, cataract surgery lowers the corneal sensitivity, and these eyes tolerate corneal lenses very well. The patient's need for a contact lens and his earnest desire to wear one are usually the deciding factors.

Q. *During a mass survey for glaucoma a patient of mine was found to have normal intraocular pressure. Several of his relatives have glaucoma and he has developed a glaucoma phobia. What can be done to reassure him?*

A. Although glaucoma surveys discover persons afflicted with this disease, they do not exclude its presence. Intraocular tension shows daily variations and the finding of a normal tension on one occasion is certainly not conclusive. In addition, there are many conditions that bring about excessive rise in intraocular pressure in eyes with glaucoma. If no undue rise in pressure is found during the so-called provocative tests, simulating these conditions, the patient may be considered reasonably safe from glaucoma. In conclusion, a careful study and explanation of the condition and

its premonitory signs by an ophthalmologist are usually adequate to reassure the patient.

Q. *As a general practitioner, I frequently find myself treating eye emergencies. Why do ophthalmologists object when I prescribe topical steroids? They seem to bring great relief to so many patients.*

A. It is true that steroids are very helpful in relieving many distressing eye symptoms. However, they may be dangerous in certain eye diseases because they mask the actual condition or may even be detrimental, as in herpes simplex of the cornea and possibly other viral infections. In herpetic corneal lesions, which may initially appear as nothing more than a corneal abrasion, the administration of topical steroids may result in a rapidly spreading and destructive ulceration. Differential diagnosis can be made in such a case only with the use of special instruments usually not available to nonophthalmologists. It is therefore much safer for a general practitioner not to apply topical steroids to the eyeball.

Q. *Can styes be caused by eyestrain?*

A. Yes. Eyestrain frequently leads to blepharitis, which in turn predisposes to the formation of styes. Errors of refraction, anomalies of accommodation and/or convergence, and lack of balance between extraocular muscles are often the underlying cause of eyestrain. On the other hand, stys may be found in patients harboring a focus of staphylococcic infection in their teeth, tonsils, nasopharynx, sinuses, or gastrointestinal tract.

George Z. Carter, M.D.
New York, N. Y.

Barraquer Institute Postgraduate Course

The Barraquer Institute Postgraduate Course in Ophthalmology for 1956–1957 was held June 3 to 8 at the Institute, Barcelona, Spain. Included in the sessions were talks on "Surgical Ophthalmologic Therapy in 1957," "Keratoplasty," "Surgical Therapy of Glaucoma: Technique of Election," "Plastic Surgery of the Eyelids," and others.

CASE REPORT

Herpes Simplex of the Cornea

A 30 year old woman was seen in the office complaining of pain, lachrymation, a foreign body sensation, and photophobia of the left eye. She stated that eight years previously she had had a similar condition of the left eye that was treated for six weeks.

Examination revealed infection of the conjunctiva, minimal ciliary injection, and a typical dendritic figure of the cornea centrally. With the slit lamp, a faint flare and a few cells were seen in the anterior chamber. In addition, there was superficial scarring of the cornea laterally, presumably as a residuum of the previous attack. Tetracaine hydrochloride, 2 per cent solution, being used as a local anesthetic, the involved area of the cornea was scrubbed with a cotton applicator impregnated in tincture of iodine. After this, the eye was carefully irrigated with normal saline. The cauterization is best done under slit-lamp visualization so that the entire area of involved epithelium is removed. U.S.P. ether is preferred by some clinicians. Complete denudation of the corneal epithelium is advocated, but in the author's experience it is not preferable to selective cauterization of the involved area. This patient was then given 1 per cent atropine to use twice daily, and sodium sulfacetamide, 10 per cent in methyl cellulose, to use every three hours to prevent secondary infection. No patch was applied in this case, but they are used routinely by some ophthalmologists. The patient was seen every other day for three visits, after which time the cornea had completely healed. All medication was then discontinued.

She was rechecked two weeks later. There was no corneal staining with 2 per cent sodium fluorescein, and the patient had no complaints. The visual acuity had not been reduced by this vigorous therapy.

COMMENT

Herpes simplex of the cornea is usually manifest as a dendritic keratitis or as a superficial punctate keratitis. The virus may be dormant in the tissues of the cornea for many years only to be reactivated by trauma or reduced resistance of the host. After the acute phase, especially if there is scarring and loss of vision, a lamellar corneal transplant is advisable to eliminate the dormant virus and bring new healthy tissue to the area.

Corticosteroids appear to act on corneal tissues in some way that reduces their resistance to the virus and invites an acute attack. Whenever the drug is being used locally, the patient should be watched very carefully for early signs of a dendritic ulcer. The author has *not* seen such an ulcer develop on the cornea during the course of steroid therapy used systemically.

Dahar Cury, M.D.
Huntington Park, Calif.

EDITOR'S NOTE: This section will be devoted to case histories of typical daily problems in the eye field. It is designed to help the reader toward a better understanding of diagnoses and treatment in ophthalmology

News and Notes in Ophthalmology

A technique for long-time preservation of live corneal tissues is being studied at Duke University School of Medicine under a U. S. Public Health Service grant. The technique involves storage in special chemical solutions at about minus 50 degrees. The project is headed by Dr. Nicholas G. Georgiade, Assistant Professor of Plastic Surgery, and Dr. Frederick W. Stocker, Associate Professor of Ophthalmology, with Dr. Duncan C. Hetherington and Dr. Ivan W. Brown, Jr. [EDITOR'S NOTE: There is a great need for donor corneal tissue to be used in corneal transplantation. The co-operation of the entire medical profession is sought in obtaining post-mortem release of cadaver eyes. This can be done most effectively by the *attending physician* at the time he requests permission for a pathologic post-mortem examination. Contact the "Eye Bank" in your vicinity.]

The use of radioactive phosphorus in tracing blood circulation in the eye has been reported by Drs. Jerome Wolf Bettman and Peter Chao (Stanford University School of Medicine) at a meeting of the Association for Research in Ophthalmology. Blood cells of laboratory animals were incubated with radioactive phosphorus and then reinserted into the blood stream. Geiger counter readings showed that the proportion of blood flow was in a normal 37:1 ratio between the choroid and the retina. The results of the research, Dr. Bettman says, suggest important clues in eye disorders of man and may aid in accurately testing various drugs used for increasing blood circulation in the retina.

Phospholine iodide, a new mycotic agent, has controlled intraocular pressure in glaucoma patients who previously required combined pilocarpine, physostigmine, and acetazolamide therapy. Given only once a day on the average, the drug had a six month trial on 48 glaucoma patients chosen at random at the Wills Eye Hospital in Philadelphia, report Drs. David A. Gold, Paul A. Gold, and Irving H. Leopold. Of 87 eyes treated, glaucoma was controlled successfully in 59 with the drug. Tension was controlled in 12 of the 28 failures, but the drug was stopped because of undesirable side effects, such as dim vision, nausea, and aching brows. The drug's long-range action is beneficial since the diurnal fluctuation is lessened and the number of daily administrations is reduced.

Dr. Norman Ashton, Director of Pathology at the Institute of Ophthalmology, London University, has been awarded the Proctor Medal for his research in the pathogenesis of retrolental fibroplasia and other eye diseases. He is the first scientist outside of the United States to receive the award, which is a memorial to Dr. Francis I. Proctor, who left private practice in Boston to devote himself to eliminating trachoma in this country. The Association for Research in Ophthalmology awards the medal each year to an investigator who has made a basic contribution in the field.

health and travel

Complete proceedings of the First Symposium on Health and Travel, held in June of 1955. Travel for the young, the old, the sick; by car, air, train, boat, and space ship; in the continental U. S., Europe, Latin America, Asia; in tropical and subtropical climes. All these problems are covered in their physiologic and psychologic aspects by top specialists in their field. The monograph includes detailed information on prophylaxis and treatment, as well as historical and entertaining general data. This attractive hard-cover book is a classic reference book for your library, as well as an attractive and much appreciated gift for a fellow physician. 72 pp. **Price: $3.00.**

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